MARCH 1961 VOLUME 10 . NUMBER 3

Battelle Technical Review

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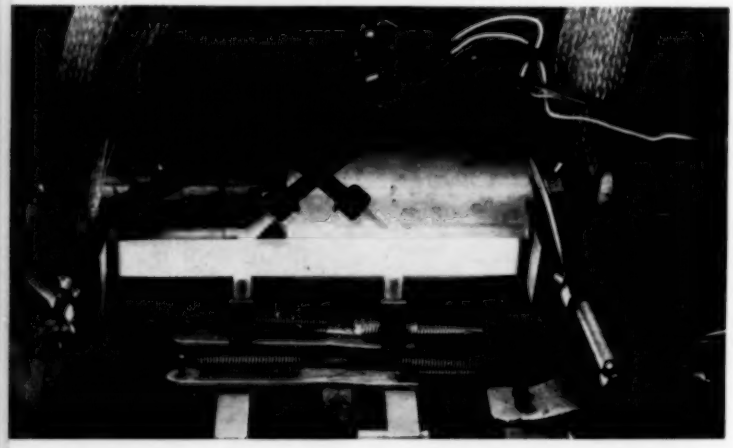
Adjusting the saturable reactor control system which regulates the current and thus the temperature of the heated specimen. Not visible is a recorder which records temperature, stress, and strain for later analysis of data.

PREDICTING METAL BEHAVIOR AT HIGH TEMPERATURES

This jet-engine alloy specimen is being heated by its own resistance to the passage of a large current of electricity. Strain in the specimen is measured and controlled by the extensometer above the specimen and the strain pacer below it.



Metals used in aircraft and space vehicles face aerodynamic heating and buffeting which may torture them beyond endurance. To create craft that will stand up under such conditions, designers must know what strengths metals will have when they are suddenly pushed, pulled, and twisted while reaching white heat.

Such data have been difficult to get. But now they can be supplied by VST (very short time) testing equipment such as that developed by a group of Battelle technologists, which included James R. Bibler, Donald P. Moon, and Clarence Paullus. The equipment shown here enables metallurgists to heat and evaluate metals quickly enough to measure the short-lived strength induced in them by cold working or special heat treating.

Metal specimens can be heated to melting or to a predetermined holding temperature in a few seconds. At the same time, the specimens can be subjected to closely-controlled stresses up to 400,000 psi. The technologists report that tensile, rapid-heating, creep, and relaxation tests may be run at temperatures well above 2000 F.

Such studies enable designers to predict the behavior of structural components under conditions of actual service. And when desired, almost any time-temperature stress or strain can be programmed and followed.

BATTELLE TECHNICAL REVIEW

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VIGNETTE

HERBERT S. KIRSCHBAUM

In a general sense, much of the research being conducted today is concerned with communication—from person to person, human being to machine, and machine to human being. "When viewed in this light," states Dr. Herbert S. Kirschbaum, of the Institute's department of engineering physics, "we can see that the nature of much of future research is certain to change. An enormous amount of work has been done on the hardware of communication during the past ten years. Now scientists and engineers must concentrate on the human being's relationship to the machine."

Much of Herb's research has been concerned with what might be termed "the interface" between the human being and the machine. His first years at the Institute were devoted to the study of the telescope-drive and -control systems of the 600-foot "dish" of the National Radio Research Station at Sugar Grove, West Virginia. He turned, then, to the study of a hot-gas servosystem suitable for extreme atmospheres. In a third servo-area Herb is interested in the theory of extremum adapting systems that can adapt their responses to changes in their environment or in their structure.

More recently he has been attacking problems associated with automatic speech recognition through the use of self-organizing networks. This interest is an outgrowth of research on adaptive systems. Typical of the thoroughness of his work is a three-dimensional model he has prepared of one person's pronunciation of the word "one", precursor of further steps in speech analyses.

Herb came to Battelle with an excellent background. He had been for over a decade assistant and then associate professor in Ohio State University's department of electrical engineering where he taught a broad spectrum of courses. During this period he also conducted research on microwave devices and circuitry and on high-power millimicrosecond pulse transformers in the University's research laboratories.

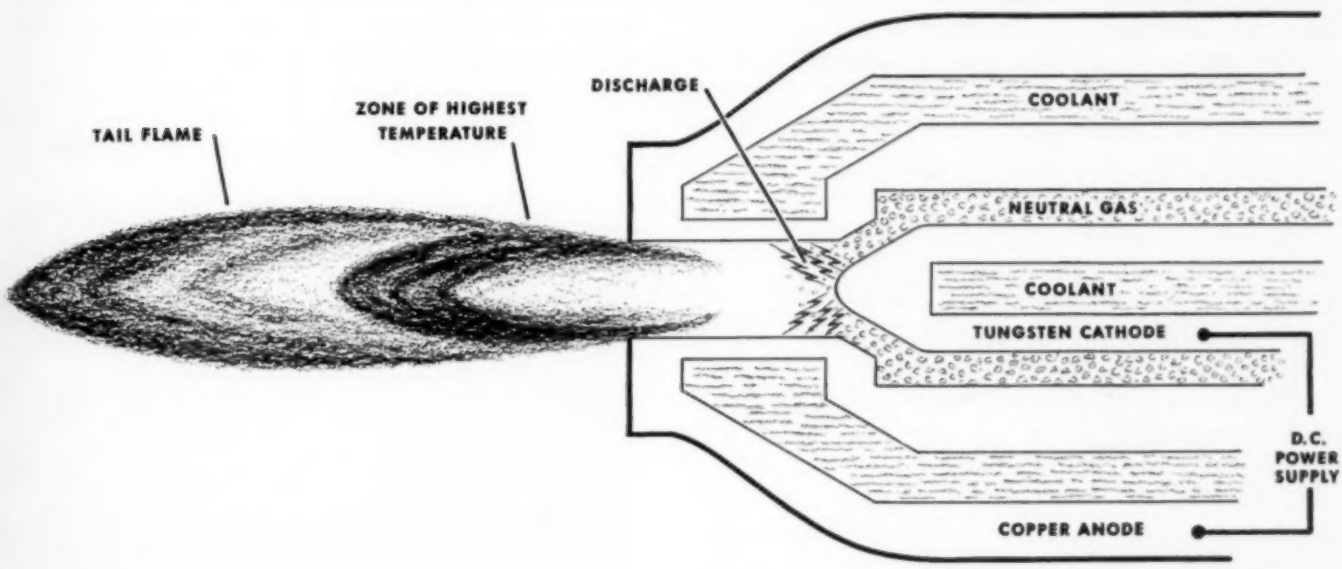
After receiving his B.S. in electrical engineering from Cooper Union, and while completing his work for an M.S. in the same field at the University of Pittsburgh, Herb was associated with the Westinghouse Electric Corporation. As an enigneer in its Industry Engineering Division he worked on power systems, closed-loop control systems, and analog computers. Later he received his Ph.D. degree in electrical engineering from the Carnegie Institute of Technology.

Herb is coauthor of a forthcoming textbook, *Fundamental Principles of Electrical Engineering,* and is author and coauthor of some dozen papers based upon his studies. His name also appears on four patents. A member of both the Research and Educational Publication Committees of the American Institute of Electrical Engineers, Herb is also active in the Institute of Radio Engineers and Sigma Xi.

At home, Herb is a confirmed disciple of the do-it-itself school, and a skilled one. With the encouragement of his wife, Dorothy, he has completed a summer house where the family can enjoy its vacations. He admits to stamp collecting along with daughters Susan, Barbara, and Karen and son Tom.

Electrochemical Aspects of Plasmas

Plasmas are known as high-temperature tools with some practical uses. Here is a discussion of their nature and potentialities, particularly in the fields of chemistry and chemical research.



Schematic of typical direct-current plasma-generating device.

by GENE G. MANNELLA

THE ACCEPTED DEFINITION OF electrochemistry is "that branch of the general discipline of physical chemistry that concerns itself with the interrelation of chemical phenomena and electricity". Since all matter is composed in part of electrical subdivisions, this definition could readily include in its broad spectrum the area of chemical kinetics and, indeed, all the interactions that macro-particles undergo.

However, electrochemistry has traditionally dealt with the realm of solutions of electrolytes and the action of electricity on such systems. It was from the research in this area by Ostwald, van't Hoff, Kohlrausch, Arrhenius, and many others that physical chemistry emerged as a separate discipline around the end of the nineteenth century.

There is no reason, on an *a posteriori* basis, why electrochemistry should not have concerned itself with the reactions and behavior of chemical species in the gas phase when such species are formed by or acted upon by electrical forces. The basic phenomenon is at least as old as the more familiar solute chemistry. The area of electrical plasmas has much to offer the chemist, physicist, and engineer, both as a promising research tool and as the basis for future industrial processes.

HISTORICAL ASPECTS

The interaction of electricity with matter and the resultant chemical synthesis may well be among man's earliest perceptions of the natural forces that surround him. F. Mohr, writing in a scientific journal over a century ago, reported that he had searched through the ballads of the blind Greek poet Homer and found frequent references to "sulphurous" odors immediately following the appearance of lighting. Thus, the formation of what was probably ozone and oxides of nitrogen by dissipation of electrical energy was recorded thousands of years before the birth of Christ. It is difficult to conceive of a more classical introduction into the literature.

On a more modern note, the electrical interaction with gases and resultant chemical synthesis is generally carried out in some sort of plasma generator.

The energy source can be any one of a number of different types, ranging from a.c. or d.c. arcs through radiofrequency or microwave electrodeless discharges. The common feature of all these units is that the electrical energy is converted into chemical energy in the form of a hot, at least partially ionized gas that has come to be called plasma.

The term "plasma" is generally accredited to Irving Langmuir and is popularly applied to any gaseous mixture of ions, electrons, and neutral particles that has an over-all electrical neutrality. Much of the early work on electrical plasmas was concerned with their strictly physical properties and was done by Langmuir and his colleagues.

The Present Concept of Plasmas

The term "plasma" as originally applied by Langmuir turned out to be a rather general one which covers an extremely wide spectrum of occurrences. To a certain extent, we are confronted today with a moderate amount of confusion regarding the definition and hence the application of a plasma. By Langmuir's original definition, almost any type of electrical discharge could qualify. Certain flames that exhibit thermal ionization also could qualify. Plasmas exist in the reaction zone of a condensed explosion, for example. On an even more extended plane, portions of the earth's atmosphere could generally be called a plasma because of the ionization produced by cosmic radiation. The atmosphere of the stars and other galactic bodies has long been considered as a plasma state by astrophysicists. Plasma is often, then, used as a generic term without reference to the origin of the particular phenomenon in question.

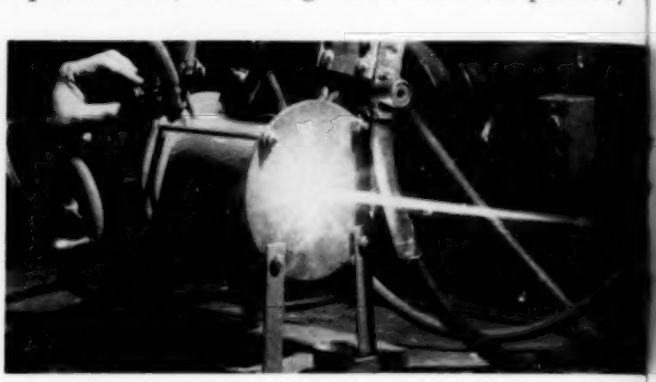
From a practical standpoint we shall limit our discussion here to the plasmas produced in an applied electric field, such as an arc. An arc is generally struck between two electrodes and is distiguished from other discharges by the high temperatures involved and the low potential drop at the cathode. The positive column of such an arc discharge always contains plasma.

If the electric arc or plasma is confined with a vortex of water or inert gas, there is an attendant increase in density and temperature and the plasma becomes a jet. If the plasma travels across a magnetic field, it becomes constricted and can assume a helical configuration. It is this principle of plasma containment that is used to produce ultrahigh temperatures in a plasmajet. There is great interest in this area in the potential application of these principles to propulsion systems for spaceships.

The quasi-neutrality of a plasma gives it unusual and sometimes anomalous properties. The average kinetic energy of a particle in a plasma can exceed the ionization potential of monatomic gases. Many researchers then compared this average particle energy of a plasma to the heat of fusion of a solid, heat of vaporization of a liquid, and heat of dissociation of a diatomic gas. The result was an energy scale that indicated that plasma was the fourth state of matter. For a long time this concept was questioned. The discovery of more highly energetic species in nuclear physics provided the extension of this energy scale to fifth and sixth states, and plasma is now generally considered the fourth state of matter.

Formation and Application of Plasmas

Although well over 99 per cent of our universe is in a plasma state, we must generate it on our planet by artificial means. In the electric arc, for example, neutral gas molecules are blown through the electron stream of the arc. The gas then becomes ionized by electron impact and the resultant mixture of ions, electrons, and neutral particles becomes a plasma. The incessant collisions among these particles and the attendant transfer of energy results in an extremely high gas temperature.



Helium is used in the arc chamber of this experimental plasmajet. Devices of this type operate in the 30,000 F range. This Battelle unit has been used in research on metal coating application techniques and in studies of the growth of single crystals of refractory materials.

A general apparatus of the arc type is shown schematically on page 3. A device of this type at Battelle is shown in operation in the photo above. At atmospheric pressure these units can develop temperatures of 20,000 to 25,000 F in the inner cone for operating periods of many hours.

The high-pressure plasma is generally considered to be near thermal equilibrium. The various species that comprise the plasma, then, are at approximately the same temperature. For a plasma at low pressures, how-

ever, equilibrium does not obtain, and it is sometimes convenient to speak of electron temperature, ionic temperature, and gas temperature. The latter two are generally of the same order of magnitude, but the electron temperature can be many thousands of degrees higher. Since our concept of temperature is based on thermodynamic equilibrium, purists will argue that the quantities obtained by conventional measuring techniques for a nonisothermal plasma are not true temperatures. For this reason, the term "temperature parameter" is sometimes more generally acceptable.

The application of plasmas today can be divided into two main categories. The first is concerned with turning chemicals into power. This area has been by far the more heavily investigated field, by both experimental and theoretical techniques. The motivation has been containment of plasma, particularly that generated by a fusion device, either for thermonuclear rocket propulsion or the more prosaic end-product of electrical power. However, mathematically tractable theoretical models are usually ill-fitted for direct application to problems in other disciplines and this research has not advanced our understanding of the chemical nature of a plasma.

The second category is the use of electrical energy to produce concentrated streams of energetic particles. The production of these highly energetic and hence highly reactive species at temperatures on the order of 20,000-30,000 F has not been widely investigated. This flux of ions, atoms, and electrons constitutes a reaction medium that could be utilized to synthesize compounds normally unobtainable at room temperature with "cold" molecules. It could also be used to impart reactivity to chemicals normally considered inert.

Work done with the plasma as an electrochemical reactor has mostly been aimed at synthesizing a particular compound. Few reports can be found in the literature regarding research on the basic chemical description of a plasma. Significantly, a large fraction of the work that is now being done on the basic study of the chemical aspects originates within the U.S.S.R.

Early Studies in the Arc

The contained arc is probably the natural precursor of present plasma devices. Its use did not necessarily embody the present concept of plasmas. Indeed, the arc was used for its high temperatures for almost a century before the term "plasma" was introduced.

Numerous patents exist on the formation of various chemicals in one or another of the different types of arcs. The most commonly investigated materials are ammonia, NH_3; acetylene, C_2H_2; and hydrazine, $(NH_2)_2$. The study of the synthesis and decomposition of NH_3 by electricity dates back to the late 18th century. The earliest experiments involved decomposition of ammonia in a spark and were reported in 1790; synthesis was not accomplished for another 70 years. Much of the work in this field has been done in Germany and France, particularly around the beginning of this century. This research was no doubt strongly influenced by the industrial, military, and agricultural importance of ammonia. The success of F. Haber with the high-pressure synthesis of NH_3 did much to discourage work on the arc process.

During the NH_3 studies, it was established that hydrazine formation usually accompanied ammonia decomposition. Several decades later, the interest in this chemical as a rocket propellant stimulated efforts to synthesize hydrazine in an arc on an economic basis. Discovery of cheaper ways to produce anhydrous hydrazine minimized interest in its high-temperature synthesis, and this work also ceased.

The synthesis of acetylene from low-cost materials such as methane has been a goal of the chemical process industry for over half a century. Many studies have been made of this synthesis in an electric arc, but no set of conditions has been found which yields a clean product at high conversion.

In reviewing these studies, it becomes apparent that while certain contributions in technique and equipment development have been made, very little of fundamental importance regarding the general chemical nature of the arc has been obtained. This lack of basic data probably contributed heavily to the failure or limited success of these studies.

Plasma as an Electrochemical Reactor

There are many mathematical and physical parameters that characterize a plasma; there are also gen-

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Dr. Mannella recently began, at Battelle, fundamental studies of the chemical nature of plasmas. Earlier, after receiving his Ph.D. degree in chemical engineering from Rensselaer Polytechnic Institute, he participated in research with Dr. Paul Harteck on isotope separation, the chemistry of the upper atmosphere, and on surface-catalyzed excitation as associated with recombinations of atoms. For a period, also, he was associated with du Pont in the development of calcium-aluminum alloys and in the study of problems associated with spray drying. Mannella's doctoral dissertation dealt with the reduction of tungsten oxides with hydrogen. He is author or co-author of ten papers based upon his various studies.

eral assumptions regarding their thermodynamics that are useful in identifying a plasma. However, the most important feature from a chemical viewpoint is the high temperature available. As pointed out earlier, temperatures of 20,000-30,000 F are feasible in modest laboratory units. An upper limit of at least several times this is practical once the materials problem is solved. A goal of 90,000 F is sought in the constricted plasma. At these temperatures, the gas would consist mainly of ionized particles and electrons with a unit energy content higher than that available for sustained periods of time anywhere outside the chemonuclear reactor.

Application of the high temperatures *per se* has been made to problems of fusing or sintering refractory materials. At least three commercial "plasma guns" are now available for spraying high-melting materials onto almost any base material. Because of the high thermal gradients, these units have the advantage that the item being sprayed remains relatively cool. Such units are compact, one-man devices with an operating range from 10,000-30,000 F depending on gas flow and power input.

Materials such as tungsten (m.p. 6170 F), tungsten carbide (m.p. 5198 F), and many other refractory compounds that melt without decomposition have been sprayed with these units. The high velocity of impingement results in strong bonding to the work surface. This technique is of tremendous importance in the rocket field, where the materials problem is most severe. These units can also be used as ultrahigh-temperature welding and cutting torches.

The high temperatures inherent in a plasma could also be used to good advantage in promoting chemical reactions. Reactions that were prohibitively endothermic at room or modestly high temperatures might be more feasible at the temperatures available in a plasma. Also, by selecting one of the reactants as the gas to produce the plasma, a supply of dissociated atoms might be made available to further enhance the reaction rate.

Little has been done to investigate the chemical phenomena that occur in a hot, partially ionized gas. Basic data on the nature and concentration of species available and the effect of operating parameters such as pressure and power level will permit a more scientific approach to the problems of synthesis at high temperatures. The potential of the plasma in this area is greatest for improved economics of reactions that require high energy inputs. This could engender a new field of exotic high-temperature materials, as well as make economically feasible reaction routes that are too expensive with traditional techniques.

The Plasma as a Research Tool

The electrical plasma also has outstanding possibilities as a research tool. It should be possible to use a plasma to generate a stream of completely dissociated atoms that could be employed to study recombination rates without the disturbing side effects of the diatomic parent. This system might be used as well to evaluate the role of various molecules as the third body in such recombinations. A plasma could also be utilized to study the kinetics of ion recombination, charge-transfer reactions, and the kinetics of electronically excited neutral molecules. As a source of free radicals, the plasma is useful in the rapidly progressing field of free-radical formation and trapping.

These problems are representative areas of reaction kinetics where little is known but where the need for new information is great. Obviously, complex problems will arise when dealing with this new medium, but their eventual solution must be regarded as inevitable.

This does not, of course, imply that plasmas do not have further application outside the chemical field. They offer possibilities as artificial atmospheres for the study of rocket re-entry problems. A plasma betatron has been proposed where a plasma would be used to inject, guide, and accelerate charged particles. The rotating disc plasma could be used as an energy storage system more suitable for certain research problems than conventional chemical systems. Also, since recent work indicates that radiofrequency waves from stars are related to plasma oscillations, research on plasmas may some day explain cosmic radio noise.

The potential of electrical plasmas as electrochemical reactors for basic kinetic studies and for applied chemical research has only now begun to receive attention. This potential had long been relegated to a secondary position behind the more immediate applications of plasma containment. However, the gradual awareness of industrial possibilities for plasmas has now created a strong need for basic studies of their chemical nature.

The importance of these studies may be inferred from a comparison with combustion. Sir Alfred Egerton, F.R.S., states in *Spectroscopy and Combustion Theory* by A. G. Gaydon, "The history of the progress of chemistry is knit closely with the study of combustion . . ." Certainly, in view of the tremendous scientific discoveries that grew out of combustion research in the first half of this century, this is very true. Combustion is now reaching the apex of its development, however, and cannot be counted on to become the prime agent of energy release and high temperature in the complex technological processes of the space age. Perhaps what combustion has been to the past, plasma will be to the future.

CLIPPO 707:

A RESEARCH FABLE

an invention of George Cline Smith*

The Electric Railway Gear Company, well-heeled, but facing a declining market, followed standard practice by diversifying into the electronic age. Renamed ERG, Inc., it made rapid strides in electronics, nucleonics, and space technology. It also cast about for more prosaic, but profitable, uses of its new talents.

A young engineer used his talent, in his spare time, and for his own amusement, to design an electronic hair-cutting machine. Guided by a computer into which were programmed a wide variety of men's hair styles, the machine could, in a matter of seconds, take detailed cranial measurements, makes necessary adjustments for the selected hair style, and produce a neat trim.

A vice president of ERG, Inc., became intrigued by the machine's possibilities. Market surveys revealed that the barber business, while not a major cog in the economy, is, nevertheless, a respectable service industry; it employs about 200,000 people and grosses close to a billion dollars a year.

The ERG management decided to build a prototype. Considerable investment was necessary, but the result, after all the bugs were ironed out, was a machine that worked beautifully. Though expensive to manufacture,

*Dr. Smith is Vice President and Chief Economist of the F. W. Dodge Corporation. The material presented here was part of his lecture, "Is Product R&D a Headache for the Service Industries?", which was delivered in the Battelle Seminar Series on "Research and Economic Growth".

it promised to deliver finished haircuts far faster, better, and cheaper than the old-fashioned barber. Economic analysis clearly indicated that it stood a good chance of revolutionizing the barber shops of the nation. The profit potential seemed excellent.

So ERG, Inc., tooled up one of its old plants at Tonsorial Falls, Ohio, to manufacture what was to be known as the Clippo 707.

At this point, the market development experts were called in. They agreed that it would be necessary to make a splash in introducing the machine. Eventually, they settled on Nick's Barber Shop, on a crowded side street just off Times Square in New York City as the place. Nick gave them a chilly reception at first, but soon succumbed to the blandishments of ERG's top management.

It quickly became apparent that Nick could not finance the Clippo 707 on his own. This was no obstacle. ERG was only too happy to lend him a machine, but the Finance Department began to have qualms. If Nick were typical, ERG would have to lease or otherwise finance all of its installations in the future.

While Nick was good with the shears, he hardly qualified as an electronics expert. So he was brought to the factory for a six-weeks training course. It occurred to the Finance Department at this point that if the Clippo 707 ever took hold, there would have to be a budget item for a barber college.

Eventually, Nick was certified as qualified, and the first production model of the machine was installed in his shop. The grand opening was scheduled for Monday. On Sunday, Nick decided to try the machine on himself. Poof! Sparks flew and smoke welled up.

Phones rang all over Tonsorial Falls, breaking the Sunday calm. The designer himself took the first plane to New York. The damage proved to be minor. The vice president, finance, saw another need—service men would have to be trained and maintained at various centers.

The ERG advertising department planned a huge joint-advertising campaign on radio, television, and in the newspapers. When asked to share the cost, Nick launched into a torrent of Greek, which, freely translated, came out: "Who ever heard of a barber shop advertising? Anyhow, I haven't got two drachmas to rub together". So ERG financed the machine, the training, the repairs, and the advertising.

But everything was ready when Nick opened his door that morning. A crowd milled around outside. And every man in it carried a placard emblazoned with "Down with Barbering Machines" and similar phrases.

A few days later, the Clippo 707 arrived back in Tonsorial Falls, express collect.

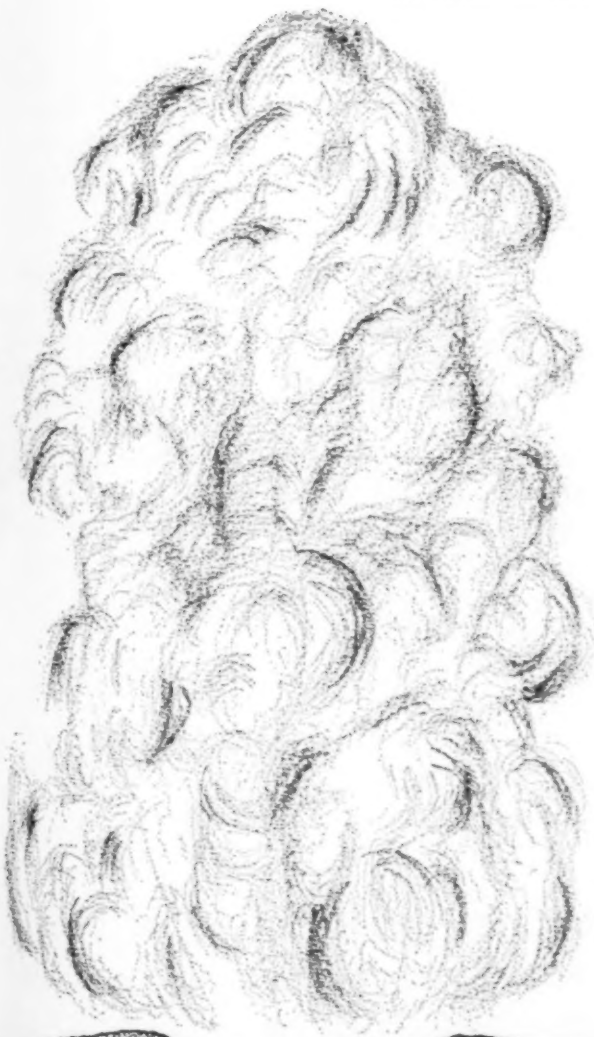
Not surprisingly, the next board meeting of ERG, Inc., was devoted largely to the fiasco. The Chairman of the Board concluded the meeting by remarking: "The service industries are certainly a bottleneck for product R&D."

Meanwhile, back at the barber shop, Nick was saying in Greek, "This product R&D is sure a headache for us service industries."

Peacetime Uses of Nuclear Explosives*

The explosive energy of nuclear fission is now being studied for its possible peacetime uses. The author considers its advantages and disadvantages and possible future applications.

by WILLIAM T. REID



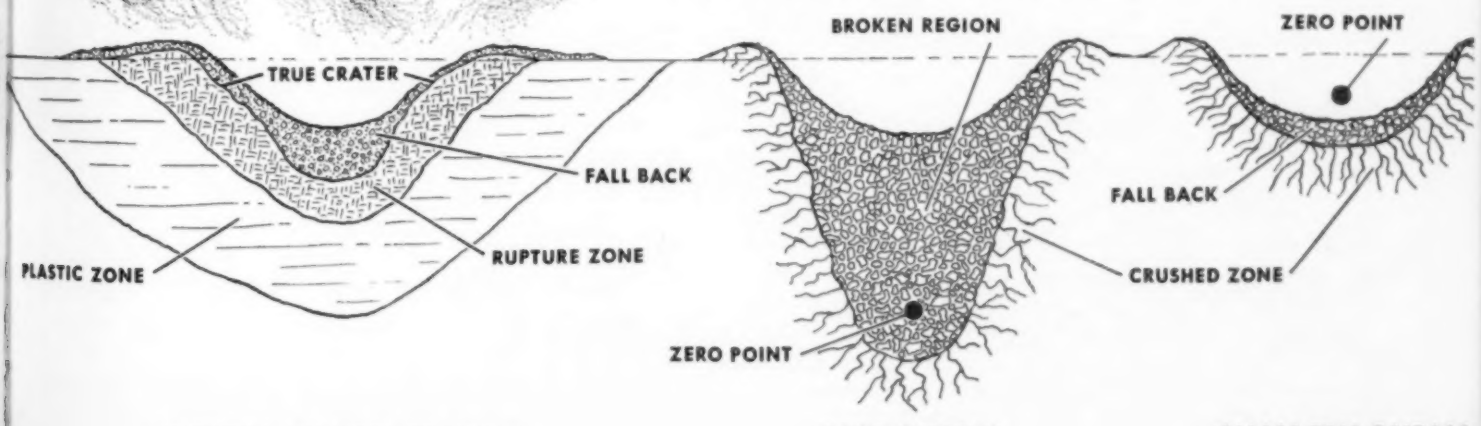
THE EXPLOSIVE ENERGY OF NUCLEAR devices, usually associated with military action, has potential value as a tool for solving a number of peacetime problems. Project Plowshare, now over three years old, was set up to probe the uses of nuclear explosives fired underground. Under this project, scientists have studied eight blasts set off at different depths in volcanic rock at the Nevada Test Site. At the same time, they have given consideration to possible nonmilitary applications of such explosions. Because of the limited experimental evidence available and the special problems involved, however, the usefulness of such energy cannot yet be fully appraised.

The experiments studied by Plowshare were intended to disclose the capabilities and limitations of nuclear explosives fired at different depths beneath the earth's surface. Table 1 shows the characteristics of these blasts. Prediction of the behavior of nuclear explosives in types of rock other than the volcanic tuff in which these shots were made is still uncertain.

The depth at which a nuclear explosive is fired, and its yield, controls the manner in which earth movement occurs. A measure of this depth, which allows for the size of the explosion, is the "scaled depth", determined by dividing the depth in feet where the explosion occurs by the cube root of the yield in kilotons. Where the scaled depth is 20 feet or less, the

*This article is based upon information which first appeared in one section of "The Applications of Atomic Energy Other than Central-Station Power Generation", a special report prepared at Battelle for the Congressional Joint Committee on Atomic Energy. The discussion presents the current and prospective technical state of the art, outlines known research in progress, discusses nonnuclear means of attaining the same objectives, and probes the economic implications involved in the use of nuclear energy in the particular situation. Since the original report was based on an exploratory survey rather than exhaustive studies of each potential application, this digest, of course, cannot be expected to be the last words on the subject.

The profile on the left shows the principal zones of a typical crater as created by a nuclear device. The other profiles show the effect of depth of burial of devices on crater formation.



material excavated is pulverized to dust and is almost entirely blown out of the crater. At a scaled depth of 65 feet there is an open crater and extensive crushing of the rock beneath the site of the explosion. Maximum crater volume occurs at a scaled depth of about 150 feet. Beyond a scaled depth of 300 feet, no open crater is formed, and all the energy of the explosion is utilized in producing an underground cavity, crushing the rock about it, and raising the temperature of the surroundings.

Thus, for earth moving, explosions at a scaled depth of about 150 feet will produce the largest crater.

In the case of the Rainier experiment, where the scaled depth was 670 feet, there was no breakthrough of the explosion at the surface. A cavity, 130 feet in radius, was formed around the detonation point, lined with 4 inches of melted rock. Within a few seconds, the roof of this cavity collapsed by successive caving upward for about 400 feet, leaving a large cylindrical shaft above the detonation point filled with crushed rock. In this experiment, where the yield was 1.7 kilotons, the explosion crushed an estimated 500,000 tons of rock and the caving produced 200,000 tons of permeable rock. On this basis for Nevada tuff, crushed rock impermeable to water amounted to 300,000 tons per kiloton yield, and rock broken by caving added 120,000 tons per kiloton yield.

About half the total energy released, or more than 3 billion Btu, was available above 400 F at the time bore holes were sunk to measure temperature. The highest temperature observed 18 months later was 194 F.

Characteristics of Nuclear Explosives

Nuclear explosives are unique compared with chemical explosives. They release larger quantities of energy than is feasible with chemical explosives, they release this energy a thousand times more rapidly than the fastest chemical detonations, and they contaminate their surroundings with radioactive wastes. Their most important characteristics for peacetime purposes are the heat released and the explosive work they can perform.

Heat Produced

Many suggestions have been made to utilize the heat released. Table 2 shows the cost of heat produced by nuclear explosives of different sizes, compared with the cost of heat produced from conventional fuels. It should be noted that these costs are based on the published prices of nuclear devices, and that independent estimates have suggested that lower prices than these may be more nearly correct. It is evident that heat from small nuclear devices is expensive, 50 to 100 times more than from conventional fuels. Even with thermonuclear devices in the 1-megaton range, the cost of energy is still about twice that from coal or natural gas. Still larger nuclear devices would cost little more, and so multimegaton thermonuclear explosives might compete costwise with conventional sources of heat if they could be used effectively.

It is interesting to compare the cost of heat from nuclear explosives with the cost of heat from the

1. CHARACTERISTICS OF UNDERGROUND NUCLEAR EXPLOSIONS IN NEVADA

EXPERIMENT	DATE	YIELD KILOTONS	DEPTH, FEET	SCALED DEPTH, FEET[a]	RADIOACTIVTITY ESCAPE, PER CENT	CRATER VOLUME Total, yd³	CRATER VOLUME Unit, yd³/kt
BUSTER-JANGLE (UNCLE)	19 Nov. 1951	1.2	17	16	50	37,000	31,000
TEAPOT (ESS)	23 Mar. 1955	1.2	67	63	50	96,000	80,000
NEPTUNE	14 Oct. 1958	0.09	99	220	1-2	33,000	370,000
BLANCA	30 Oct. 1958	23	835	290	0.1-0.2	0	0
LOGAN	15 Oct. 1958	4.5	830	500	0	0	0
RAINIER	19 Sept. 1957	1.7	790	670	0	0	0
TAMALPAIS	8 Oct. 1958	0.06	830	840	0[b]	0	0
EVANS	28 Oct. 1958	0.05	840	2260	0[c]	0	0

Data from John, G. W., "Mineral Resources Development by the Use of Nuclear Explosives", Lawrence Radiation Laboratory, UCRL-5458, p. 10 (February 5, 1959). Hearing Before the Special Subcommittee on Radiation, Joint Committee on Atomic Energy, 5-8 May 1959, Vol. 3, pp. 2523-2531.

(a) Scaled depth = Depth (Ft)/Yield (kilotons)$^{1/3}$.
(b) No breakthrough to surface but radioactive materials leaked into tunnel.
(c) No breakthrough, but stemming failed, releasing fission activity into tunnel.

2. COMPARISON OF ENERGY COSTS FOR NUCLEAR DEVICES AND CONVENTIONAL FUELS

	NUCLEAR DEVICES					CONVENTIONAL FUELS		
	10 kt	100 kt	1,000 kt	10,000 kt	100,000 kt	Coal[b]	Oil[c]	Gas[d]
CHARGE FOR NUCLEAR EXPLOSIVE[a]	$500,000	$750,000	$1,000,000	$1,100,000	$1,200,000	....	....	....
TYPICAL UNIT COST FOR FUELS	....	....	....	....	....	$6.50/ton	$2.50/bbl	$0.25/MC/F
COST PER THERM[e]	$2.50	$0.38	$0.05	$0.0055	$0.0006	$0.028	$0.046	$0.028

(a) Includes charges for the device, placing it in position, making attachments, firing, and safety provisions. Does not include site preparations or construction activities.
(b) Pennsylvania.
(c) New York.
(d) Texas.
(e) 100,000 Btu; 50 per cent recovery assumed for nuclear devices, 90 per cent recovery for fuels.

fissioning of fully enriched uranium, based only on the cost of the enriched uranium. The cost of heat from fully enriched uranium is nearly the same as the cost of heat from coal or natural gas, and only about half as much as that from a 1-megaton nuclear explosive. While processing costs now increase the cost of heat from enriched uranium, improvements in processing techniques and the use of lower-cost fissionable materials will give energy costs below those for the nuclear explosives. Thus, reactors appear more promising as a way of using heat from atomic energy than do nuclear explosions, at least for explosions up to 1-megaton in size.

Hence, it must be concluded that heat produced from nuclear explosions in anything except the larger sizes cannot compete economically with existing conventional processes. Costs of nuclear explosives would have to be reduced by a factor of 50 to 100 in the 10-kiloton range and by two in the megaton range to become competitive, assuming the correctness of quoted prices.

Explosive Energy Produced

Nuclear explosives provide an effective means of moving and breaking large quantities of earth and rock. Equivalent in explosive power to from 50 tons to a few million tons of conventional explosives, nuclear devices are compact, being packaged in a case from 7 to 14 feet long and 30 to 36 inches in diameter. This small size permits nuclear explosives to be placed in position more easily and at less cost than equally effective chemical explosives. Although chemical explosions of more than 500 tons have been fired, such huge blasts have been rare.

Table 3 shows the relative costs of nuclear and chemical explosives based on their heat of explosion. It is evident that nuclear devices are economically attractive. Even the cheapest of the commercial explosives costs nearly three times as much as the most expensive nuclear explosive. Comparing a megaton thermonuclear device with TNT shows that the yield per dollar is 400 times greater for the thermonuclear explosive.

However, nuclear devices are less efficient blasting materials than chemical explosives, with the result that the heat of explosion is utilized less effectively. While only 1 pound of conventional explosive is required to excavate 1 cubic yard of rock, or about 2 million cubic yards per kiloton, nuclear devices excavate from 100,000 to 300,000 cubic yards per kiloton. This fact changes the economic situation, and it is found that nuclear explosives are cheaper only for the large explosions. The cost of the explosive alone is 12 cents per cubic yard for a 100-kiloton device and 2 cents per cubic yard for a 1-megaton device, compared with 20 cents per cubic yard for conventional explosives. Larger explosions would give even cheaper blasting. Smaller nuclear explosions cost more than chemical explosions, per cubic yard excavated.

For many years, William Reid's primary interest was research on fundamental problems of combustion, heat transfer, and solid fuel utilization. Later, his interests and responsibilities broadened. He has been concerned at Battelle with the guidance and coordination of studies in the graphic arts, and in certain areas of mechanical engineering and electrical engineering. Recently, he has been participating in fuel-cell technology studies. Prior to his association with Battelle, Reid was supervisor of combustion research at the Bureau of Mines. Among his other activities, he edits the *TAGA Newsletter* for the Technical Association of the Graphic Arts, and is active in the Fuels Division and the Furnace Performance Factors and Solar Energy Applications Committees of the American Society of Mechanical Engineers.

On this basis, where large explosions are required or can be tolerated, nuclear explosives are cheaper than chemical explosives.

Radiation Hazards

Radiation is a problem with nuclear explosions, although the fireball is completely suppressed and there is no flash or incendiary effect with even shallowly buried explosions. Shallow blasts, nevertheless, discharge nearly all their radioactivity into the air. As the depth increases, more of the radioactive debris is trapped in the surrounding soil, until with the deepest blasts no radiation is detectable at the surface.

Radioactivity trapped in the zone surrounding a deeply buried explosion is confined largely to a shallow layer of fused rock. This radioactivity can be transferred to ground water flowing through the site of the explosion, but is quickly absorbed by strata outside the explosion area. In general, the problem of transferring radioactivity from a deeply buried explosion to underground water supplies is not considered serious, but the problem has not yet been entirely evaluated. Far more study would be required before it could be proved that a radiation hazard did not exist for any given situation. Radioactivity trapped in the soil or in rock would pose special problems in mining.

Seismic Shock

Ground waves produced by underground nuclear explosions are relatively weak, although they have served effectively to increase man's knowledge of the earth's crust. Similar in some respects to an earthquake, nuclear-explosion-induced seismic disturbances die out far more rapidly than do natural earth tremors. Thus, although localized effects are similar to those from an earthquake, the intensity and range of damaging effects from an underground nuclear explosion are appreciably less.

Possible Future Uses of Nuclear Explosives

Because of their effectiveness in excavating, nuclear explosives have been suggested in a test known as Project Chariot for producing a harbor on the Alaskan coast at Cape Thompson, 350 miles above the Arctic Circle. A harbor in this location would facilitate exploitation of Alaska's reserves of coal and oil. It was proposed initially that five nuclear devices be exploded simultaneously, three 20-kiloton explosions to provide an entrance channel, and two 200-kiloton explosions to form the main turning basin. Later plans call for only four nuclear devices in this experiment. At a scaled depth of 260 feet, most of the excavated permafrost soil would be thrown free of the craters, and from 5 to 20 per cent of the radioactivity would be released. The isolated location of the experiment would minimize problems of fall-out.

Another suggestion has been to excavate a canal across Central America, 100 miles south of the Panama Canal. As visualized, this would require the firing of 651 nuclear devices having a total yield of 42 megatons at a cost estimated at $2.1 billion. It is estimated that excavating with conventional explosives might cost $5.1 billion. There appears to be little likelihood that such a project would be undertaken.

Although thermal energy from nuclear explosives

3. COMPARATIVE COSTS OF NUCLEAR AND CHEMICAL EXPLOSIVES

	NUCLEAR DEVICES			AMMONIUM NITRATE, FERTILIZER GRADE	40% BLASTING GELATINE, 2 x 16 CARTRIDGES	60% BLASTING GELATINE, 2½ x 16 CARTRIDGES	TNT
	10 kt	100 kt	1000 kt				
CHARGE FOR NUCLEAR EXPLOSIVE	$500,000	$750,000	$1,000,000	....	....	....	....
TYPICAL COST OF CHEMICAL EXPLOSIVES, $/100 POUNDS	....	....	....	$6.75	$18.25	$19.25	$20.00(a)
ENERGY IN NUCLEAR EXPLOSION, BTU	4×10^{10}	4×10^{11}	4×10^{12}	....	....	....	....
BTU/$(b)	8×10^{4}	5.3×10^{5}	4×10^{6}	3×10^{4}	1.1×10^{4}	1.0×10^{4}	1×10^{4}
RELATIVE COST OF HEAT OF EXPLOSION PER MILLION BTU	$12.50	$1.88	$0.25	$34	$91	$96	$100

(a) Not being produced commercially today. Used almost solely as military explosive, with small amount added occasionally to proprietary explosives and boosters.

(b) Based on heat of explosion of 2000 Btu/pound for conventional explosives.

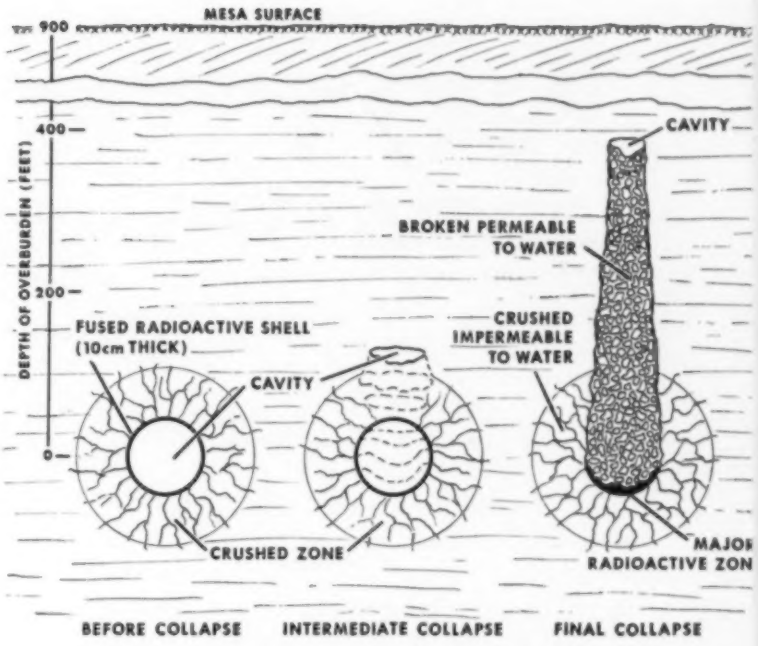
is not attractive economically at present, one test to define the technical problems more specifically has been in the planning stage for two years. Known as Project Gnome, it proposes to detonate a 10-kiloton device 1200 feet below the surface in the Salado Formation salt beds 25 miles southeast of Carlsbad, New Mexico. Information would be obtained from such a shot on some of the engineering problems involved in recovering useful heat from an underground explosion. Practical applications of such energy seems quite unlikely for many years to come.

One venture has been proposed to recover oil from the Athabasca tar sands of northern Alberta. Here the explosive energy of the device would be used to produce a large quantity of crushed tar sands 1300 feet underground, with the thermal energy providing a pool of heated low-viscosity oil which could then be pumped to the surface. No cost breakdown has been reported for Project Oilsand, the main intent apparently being to explore any possible method of recovering useful products from this exceedingly large hydrocarbon deposit.

Suggestions have been made that nuclear devices detonated in an oil-bearing strata could increase the recovery of petroleum from a given reserve at lower cost than conventional methods. Too little information is available as yet to predict the action of a nuclear device in such an application. Because of the size of a nuclear device, a cased hole larger than 30 inches in diameter would be required to place the nuclear explosive in position. Although cased holes as large as 42 inches have been drilled, their cost has been high. With most of the oil reserves in the United States located between 2000 and 8000 feet below the surface, it does not appear practical at present to exploit these with nuclear explosives.

Oil shale also has been considered for testing the usefulness of a nuclear explosive. Two possibilities exist: (a) to use the nuclear explosion to crush the shale prior to mining it and transporting it to a processing plant, or (b) to use the nuclear explosion to initiate controlled combustion in the shale and to retort it in place. Economically, neither method appears promising. The feasibility of either scheme cannot be appraised at the present time.

Improvement in mining practices by the use of nuclear devices has been considered because of the favorable costs of nuclear explosives. Although the feasibility of nuclear blasting seems established, application to mining where small, controlled explosions are necessary has not been demonstrated. The need for caution against damaging irreplaceable ore bodies by large nuclear blasts should delay tests in mineral deposits until data are available on the action and



The sequence left to right of actions around the point of detonation of a nuclear device.

effect of nuclear devices in rock of different types.

Because there are many areas in the world where potable water is in short supply, nuclear explosions have been considered for supplying the heat needed for distillation processes, or for producing underground aquifers where water could be stored. Heat from nuclear explosions is too costly for distillation except for very large nuclear devices, particularly in view of the high thermal efficiency now obtained by distillation plants using conventional energy sources.

Underground storage basins produced by deeply buried nuclear explosions may have more merit, but their potentialities cannot be estimated until more data are available on the characteristics of such explosions in different types of underground structures, and on the extent of radioactive contamination.

Conclusion

The Plowshare studies are in a preliminary stage, suggested uses are speculative, and it is too early to make adequate evaluations of the ultimate uses for which nuclear explosives might be practical. Many tests would need to be made before the capabilities and the limitations of these devices can be stated. Nevertheless, it is interesting to note that man's continual quest for new and cheaper sources of energy has led to this usual search for a practical means of realizing the Biblical prophecy, ". . . . and they shall beat their swords into plowshares and their spears into pruning hooks . . ."

NOTES from BATTELLE

✱ METALS IN CRYOGENIC LIQUIDS

The powerful liquid propellants (oxygen, fluorine, and hydrogen) used in missile systems call for special attention to the materials used in the construction of the vehicles. In missiles themselves, short-term exposure to propellants is the rule. In auxiliary equipment—storage tanks, pipelines, and pumps—exposure is much longer, but less strength is required of the containing metals.

A review of the corrosion and physical behavior of metals in these propellants was presented last month by James D. Jackson before the Materials of Construction Symposium, held in connection with the annual meeting of the American Institute of Chemical Engineers at New Orleans.

The Battelle chemical engineer pointed out that materials problems in connection with propellants grow out of the physical properties of metals at very low temperatures and the corrosive nature of some of the fuels. Oxygen is liquid from -297 to -360 F at atmospheric pressure, and under most conditions it is quite inert. Fluorine, which is liquid from -306 to -353 F, is the most active element known and is highly toxic. Yet it is readily contained in pure liquid form if caution is used. The very low temperature of liquid hydrogen, -423 to -434 F, creates serious problems in its use. While quite inert to metals and creating no corrosion problems, it does create problems of mechanical failure in some metals.

Jackson made the following observations about metals that are brought into contact with the three cryogenic liquids:

• In general, the stainless steels and aluminum-, copper-, nickel-, and magnesium-base alloys show little corrosion except in the case of liquid fluorine containing water. Where the liquid fluorine contains water, Monel is preferred.

• Because liquid oxygen and liquid fluorine react vigorously with any organic contamination to form hot spots, systems using these propellants must be kept exceptionally clean.

• Titanium in both liquid oxygen and liquid fluorine is sensitive to impact. Hence the metal should be used only where shock is unlikely.

• Aluminum, nickel, copper, and magnesium or their alloys; certain titanium alloys; and austenitic stainless steel are most satisfactory for the low-temperature conditions associated with liquid hydrogen. Metals that tend to fracture in a brittle manner (alloy steel and martensitic and ferritic stainless steels) should not be used in contact with liquid hydrogen.

✱ CARBON COATING OF CARBIDE FUELS

One of the chief difficulties in designing and constructing nuclear reactors using uranium, thorium, or plutonium carbides is the reactivity of such materials with moisture, even at room temperature, to form oxides. If such partly hydrolyzed fuel is embedded in a graphite-matrix fuel element and then subjected to operation at high temperature, generation of carbon monoxide gas and dimensional change in the elements may result. This problem has been met in the past by processing these materials in a protective atmosphere. Because of the expense and inconvenience of this technique, a method for coating powdered or granular carbide fuels with a protective film is highly desirable to permit their handling in air.

In a study at Battelle for the Atomic Energy Commission, pyrolytic carbon was investigated as an economic and effective coating for carbide fuel powders and granules. Joseph H. Oxley, Arthur C. Secrest, Neil D. Weigel, and John M. Blocher, Jr. recently described their experiments designed to gain quantitative data on the kinetics of the deposition reactions in a fluidized bed and information on the effectiveness of the coating as a moisture barrier.

The technologists were primarily interested in the ability of carbon coatings to protect the fertile material against moisture, and they used a test solution of hot, concentrated nitric acid for periods of about 8 hours to evaluate the effectiveness of the coating. They found that the coatings provide excellent protection for the powdered carbides. A 7-micron carbon coating deposited from acetylene at a temperature of 1015 C affords good protection for uranium dioxide against this acid treatment. Experiments also indicated that a 9-micron coating on uranium monocarbide, a 17-micron coating on uranium dicarbide, and a 30-micron

coating on thorium-uranium dicarbide powders gave excellent protection against the acid leach and against hydrolysis in humid air. The technologists also report indications that the protective coating may serve to retain fission products during reactor operation.

✻ READING OF MICROIMAGES

Storage of information in the form of microimages (as on microfilm or microcards) is a useful and space-saving process for libraries. But the great benefits of such storage techniques have not been fully realized. As a step toward making the use of microimages more acceptable to the reading public, the Council on Library Resources has asked applied physicists at Battelle to investigate devices for improving microimage reading.

According to Lewis E. Walkup, Institute technologists will study the physical and optical factors involved in microimage viewing. Using book reading as a standard, they will try to adjust those factors so that the reading of microimages will be as acceptable to the general user as the reading of books. This would lead to specifications that can be used by all producers of viewing equipment. The second goal of the Council is to adapt the findings in a reasonably-priced experimental viewer for sale to the general public.

Approaches to the research will include:

1. Analyzing microimage viewing to identify the psychophysical factors that affect the acceptability by users, with book reading as a standard.

2. Determining the degree to which those factors influence the user's pleasure reaction.

3. Identifying the microimage-viewing elements that increase or decrease the viewer's acceptability by users.

4. Developing methods of changing the elements and determining the combinations of elements that give the greatest acceptability by users.

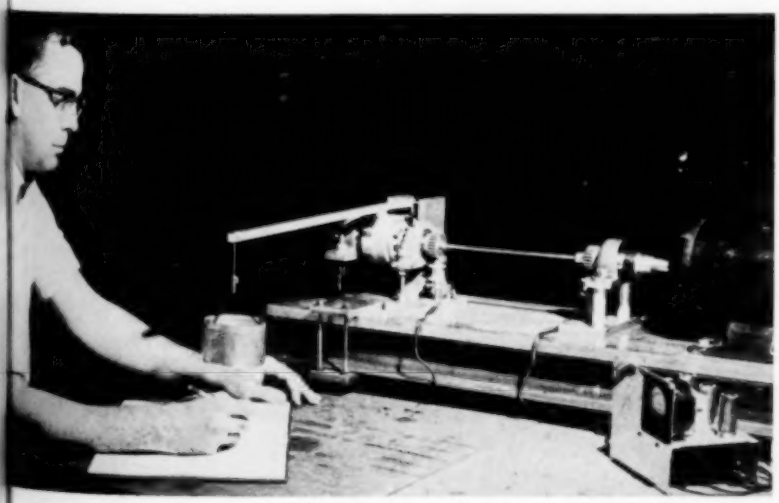
5. Constructing and evaluating demonstration models that may serve as a starting point for designing prototype equipment ultimately suitable for production.

✻ ANALYSIS OF 1959 R & D

The National Science Foundation estimates that industrial research and development expenditures for 1960 may have reached $10 billion. This would be an increase of 8 per cent over the $9.4 billion spent in 1959, which, in turn, was 15 per cent higher than the 1958 expenditures.

About 57 per cent of 1959's industrial R & D funds came from the Federal Government. This largely reflects spending on military and defense-related projects. For all industries, government-financed R & D increased 17 per cent in 1959, as compared with 1958, while company-financed research increased 12 per cent.

In 1959, the aircraft and parts and electrical equipment and communication industries exceeded all others with research expenditures of $2,973 million and $2,227 million respectively. Next came chemicals and allied products ($928 million), machinery ($910 million), motor vehicles and other transportation equipment ($863 million).



STUDY OF FRICTIONAL PROPERTIES

Determining how well automobile brake linings hold up under sustained use is, of course, an important factor in selection. Current methods of obtaining data are time consuming, requiring up to two hours to record the frictional properties of a specimen. Research at Battelle for the Grizzly Division of Maremont Automotive Products, Inc. has led to the development of equipment which is likely to reduce evaluation time to ten minutes.

Harvey H. Hunter is shown with the new equipment for study of frictional properties which he and his colleagues developed. Electric pickups, which may be seen at each end of the shaft, supply the signals providing the data. Friction forces created by applying a specimen of brake lining to a revolving drum (on the left) twist the shaft. With the change in torque the signals from the two pickups shift in phase. Thus, increases and decreases in friction can be read from changes in phase, as reported by the instrument in the foreground.

Industries receiving the largest proportion of federal financing were aircraft and parts (86 per cent) and electrical equipment and communication (70 per cent). By contrast, drugs and medicines; stone, clay and glass products; petroleum refining and extraction; and primary metals largely financed their own research and development.

According to National Science Foundation figures and definitions, industries spent $344 million for "basic" research in 1959, which was 4 per cent of their total research expenditures. This total was 17 per cent greater than the $295 million spent by them for the same type of research in 1958.

* AUTOMATIC PIPELINE WELDING

Automatic pipeline welding in the field is now a practical reality for the oil industry. The new process and the automatic welder are the result of several years of research and development by Esso Research and Engineering Company with the cooperation of Battelle, the Air Reduction Sales Company and Cruther-Rolfs-Cummings, Inc.

The new process makes possible new concepts of pipe handling, according to Perry J. Rieppel, Battelle welding technologist. In current methods a team of 20 men may work on welding pipe and may be strung out along the pipe for a mile or more. Only three men are needed in the new Esso Research process—a welding technician, his assistant, and a tractor driver.

The key to the process is a welding device that clamps over and welds two lengths of pipe 20 times faster than is possible with present hand-welding techniques. In the new process, steel pipe is strung along the ditch in which it is to be buried. The tractor aids in lifting pipe to be welded and in placing the automatic welder over the pipe ends. The ends are held firmly together by a specially devised internal alignment clamp inserted in each pipe. After completion of the welding, the clamp is collapsed and withdrawn to the next joint.

When the automatic welder is in position over the pipe ends, it firmly clamps in place with its dual prongs. An air-driven abrasive cutting wheel then slices a minute sliver from each of the pipe ends. It does this in two circular sweeps at the pipes. An arc welder follows in the track of the cutter and performs the weld. The continuous process needs only two motions of the cutter and two of the arc welder to do the job. On eight-inch pipe the weld is completed in one minute and is as strong as manual welds requiring up to 20 minutes. After the cutter prepares the pipe ends, no further treatment of any kind is needed.

The major problem solved in perfecting the new technique was how to weld without rotating the pipe. Other automatic welders cannot be used in modern pipeline construction since they require rotating of the pipe to ensure a perfect weld. The new system eliminates the need for rotation. The welder has undergone a six-month evaluation and successful field test in the Odessa oil fields of West Texas. While the new system is designed for use with 4-, 6-, and 8-inch diameter pipes, it can be easily adapted for even 30-inch and larger diameter piping.

The economic importance of fast and efficient welding is underscored by the fact that 27,492 miles of pipe will be laid in the world in 1961. A weld will be needed approximately every 50 feet along these miles of pipe.

USE OF STRONGER METALS leads to lighter structural components and thus provides a bonus whenever structures move or are transported. The lesson has been "driven home" in space-vehicle technology and, according to George K. Manning, is spreading rapidly in other applications. Successful use of steels in the 400,000 to 500,000 psi strength range, which may be expected in a few years, will make even lighter structures possible. Manning points out that contributions to lighter, stronger structures will also come from: improved design concepts that give better load distribution and less stress concentration; new fabrication techniques such as high strain-rate deformation techniques, spin forming, and better joining techniques; and advanced nondestructive inspection procedures to assure smaller maximum flaw sizes.

IMPROVED METAL FINISHING resulting from use of better protective coating with electroplates and from stock removal by electrolytic, in place of mechanical, methods, is foreseen by Charles L. Faust. As examples of better electroplates he cites duplex nickel overlaid with crackfree chromium; chromium-nickel-chromium combinations; and duplex nickel overlaid with microcracked chromium. Faust, who guides electrochemical engineering research at Battelle, also points out the prospects of better protection against corrosion and oxidation from alloy coatings formed by plating layers of metals and then alloying them by diffusion heat treatment.

Metal stock now can be removed accurately by electrolysis, Faust states. This process, which is essentially directed electropolishing, leaves a surface with the true structure of the basis metal and free from stress and disturbed metal.

RADIOTRACER WEAR RATES of top piston rings and cylinder liners provide valuable information in research on a diesel engine. This is the conclusion of N. J. Beck of Cummins Engine Company and Robert B. Price, Duane N. Sunderman, Alfred W. Carey, Jr., and Ward S. Diethorn of Battelle after a study for the Cummins Engine Company. The wear rates proved to be in good agreement with rates predicted from field experience. Furthermore, the rates provided performance information of immediate interest to the engine designer, and the data revealed new details of the wear behavior of the engine parts.

The technologists say the study shows that the method is reliable, sensitive, and rapid, and that more extensive use of this tool is justified in engine development programs in which wear is a likely problem.

BATTELLE STAFF MEMBERS recently named to technical posts include: *Francis W. Boulger*—member, American Society for Testing Materials, Petroleum Products and Lubricants Committee; *Frank C. Croxton*—member, Research Committee, American Institute of Chemical Engineers; *Winston H. Duckworth*—judge, PACE Award, National Institute of Ceramic Engineers; *James A. Eibling*—assistant secretary, Solar Applications Committee, American Society of Mechanical Engineers; *Richard B. Engdahl*—member, Study Committee on Research in Small Colleges, Council, American Association for the Advancement of Science; *Frederick W. Fink*—member, Executive Committee, Corrosion Division, The Electrochemical Society *and* member, Corrosion Resistant Metals Committee, American Institute of Mining, Metallurgical, and Petroleum Engineers; *William A. Glaeser*—chairman, Subcommittee on Information, Bearings and Bearings Lubrication Technical Committee, American Society of Lubrication Engineers; *E. H. Lougher*—honorary editorial advisor, INTERNATIONAL JOURNAL OF ADVANCED ENERGY CONVERSIONS; *E. R. Mueller*—chairman-elect, Division of Organic Coatings and Plastic Chemistry, American Chemical Society.

Writings by STAFF Members

Variational Treatment of Warm Electrons in Nonpolar Crystals. Deviations from Ohm's law in nonpolar crystals are treated for weak fields by the variational method. A simple band structure is assumed. Scattering by both acoustical and optical phonons, and ionized impurities is included. It is shown that the influence of optical phonons on the field dependent mobility is maximum for a temperature which corresponds approximately to the optical phonon energy. The field dependent mobility is highly sensitive to ionized impurity scattering as in the case of acoustical phonons alone. Finally, the convergence of the variational method is established in limiting cases using as a representation a set of polynomials which are orthanormal with respect to the collision operator. Extensive calculations are given for electrons in germanium and comparison with experiment is discussed. ***I. Adawi.*** *Physical Review*, v. 120, no. 1, Oct. 1, 1960, p. 118-127.

High-Temperature Bearing Properties and Cobalt-Base Alloys. The specific requirements of high-temperature bearing properties seem to be met by cobalt alloys. What seems to be lacking is a systematic investigation of the various high-temperature cobalt-base alloys under actual bearing conditions. There is also little mention in the literature of development of cobalt-base alloys specifically for high-temperature bearing use. On the basis of this literature survey, there are strong indications that cobalt-base alloys may be developed into bearing materials having outstanding properties. ***M. F. Amateau.*** *Cobalt*, no. 9, Dec. 1960, p. 27-33.

Radiation Effects in Compound Semiconductors. The number of carriers removed per incident neutron are compared for the following materials: SiC, Si, GaAs, InP, Ge, AlSb, and CdTe. Analysis of post-irradiation measurements indicated bombardment-produced levels in AlSb at 0.33 *ev* above the valence band, in InP at 0.28 *ev* below the conduction band, and in GaAs at about 0.14 *ev* below the conduction band. Below room temperature (≈250 K) at "mobility catastrophy" was observed in an irradiated GaAs specimen. High temperature annealing studies carried on GaAs indicate an annealing process at about 300 C, and further annealing above 400 C. ***L. W. Aukerman.*** Paper from *Proceedings of the Second Conference on Nuclear Radiation Effects on Semiconductor Devices, Materials and Circuits*, p. 26-30, 1960. Cowan Publishing Corp., New York .QC612.S4 C77 p Over.)

Development of an Analytical Method for Emission-Spectrographic Determination of Alkali Without Classical Chemical Methods of Previous Fusion or Dissolving. Two methods are described for the rapid spectrographic analysis of alkali in a variety of test materials. If the Na 3302 and K 4044

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spectral lines are used for analysis, standard spectrographic equipment with ultra-violet sensitive film can be used. The precision of this method permits quantitative analyses to as low as 0.1% Na_2O. If the Na 5890 and K 7655 lines are used, even smaller alkali concentrations can be determined and the preparation of the samples is easier because the analytical sample is merely diluted with graphite powder. As it is often difficult to procure special films sensitive to infrared light, this method is only recommended for routine work. With slight variations, the second method can also be used for determinations of very small alkali concentrations in organic substances. *Battelle Memorial Institute.* PB 149430; *Final Report,* Dec. 1, 1959-May 15, 1960, 23 pp. (LC mi $2.70, ph $4.80).

Progress in Carbide Fuels. Notes from the Second AEC Uranium Carbide Meeting Held at Battelle Memorial Institute March 22 and 23, 1960. Surveys work in progress and future plans of various laboratories where research is being conducted toward the use of uranium carbide fuels in nuclear reactors. Discussions include: raw-material preparation by chemical techniques and powder metallurgy; melting and casting; measurement of mechanical, physical, and chemical properties; determination of diffusion rates in carbides; and study of irradiation-damage processes. Battelle Memorial Institute. U. S. Atomic Energy Commission, *TID-7589,* April 20, 1960, 99 pp. (OTS. $2.25).

The Gamma to Epsilon Transformation in Zr 20 to 70 Wt Pct U Alloys. In this range of compositions the γ phase can be retained by quenching. Transformation to ϵ occurs by a nucleation-and-growth process. The diffusion of atoms to preferred lattice sites to yield a partially ordered structure apparently controls the rate of reaction. Alpha uranium and zirconium precipitate from the supersaturated ϵ phase initially formed in alloys outside the equilibrium phase composition limits. ***A. A. Bauer.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 218, Aug. 1960, p. 636-644.

Selected References to Astia Documents on Machining. The references were selected from appropriate sections of the Technical Abstract Bulletin prepared by the Armed Services Technical Information Agency (ASTIA). They are grouped under the following headings: machining practices; tool materials; machining properties (machinability); program-controlled tools; alternate methods of machining; machine tools; metal-cutting phenomena; cutting fluids; automated processes; miscellaneous ***F. W. Boulger and M. B. Gold.*** PB 161211; Defense Metals Information Center, *DMIC Memorandum* 61, August 11, 1960, 51 pp. (OTS $0.50).

Compatibility of Rocket Propellants With Materials of Construction. This report summarizes the available information on the compatibility of liquid rocket propellants with prominent materials of construction. It is pointed out that compatibility data for materials not ordinarily covered by the Defense Metals Information Center are included. These data were found during the search for information on materials that are within the scope of the DMIC, and are included for convenience. Fuels and oxidizers of current interest are discussed. The corrosion data which are presented will apply to storing, handling, and control equipment outside of missiles and to missile components up to the combustion chamber. Consideration also is given to such factors as catalytic decomposition and sensitivity to impact. ***W. K. Boyd and E. L. White.*** No. PB 161215; Defense Metals Information Center, *DMIC Memorandum* 65, Sept. 15, 1960, 67 pp. (OTS $0.50).

Metallurgical Characteristics of A-286 Alloy. A-286 alloy is a high-temperature alloy that can cause many problems in fabrication unless its characteristics are recognized. The recommended ranges of chemical composition are shown. The absence of boron from this material can cause a soft, weak, lamellar-type precipitate after age hardening. This condition is addentuated if cold working precedes aging. This type of precipitate is illustrated. Bulging of assemblies during pressure testing has occurred when this precipitate is present, stress-rupture values are very low, and creep rate increases manyfold. ***Hiram Brown.*** PB 161209; Defense Metals Information Center, *DMIC Memorandum* 59, July 26, 1960, 7 pp. (OTS $0.50).

Metallurgical Characteristics of A-286 Alloy. Gives chemical analysis, structural data, heat-treatment and welding characteristics, and effect of aging on room-temperature and 1000 F tensile properties of this high-temperature alloy. ***Hiram Brown,*** PB 161209; Defense Metals Information Center, *DMIC Memorandum* 59, July 26, 1960, 10 pp. (OTS $0.50).

Neutron Diffraction Studies of Chromium-Modified Mn_2Sb. Existence of a ferrimagnetic to antiferromagnetic phase transition with decreasing temperature in Mn_2Sb modified with 2.3 weight percent chromium is confirmed by neutron diffraction. ***W. H. Cloud, H. S. Jarrett, A. E. Austin, and E. Adelson,*** *Physical Review,* v. 120, 2nd ser., no. 6, Dec. 15, 1960, p. 1969-1970.

Aluminum-Uranium Alloy Centrifugal Casting. Among the variables evaluated were melt temperature, mold and pouring-spout configuration, mold speed and method of pouring. The best castings were produced using a pouring temperature of 2400 F, a heavy-walled steel cylinder rotating between 700 and 900 rpm for the mold and a bottom pouring technique employing a retractable pouring spout. ***N. E. Daniel, E. L. Foster, and R. F. Dickerson.*** *Modern Castings,* v. 39, Jan. 1961, p. 53-59.

Progress Relating to Civilian Applications During December, 1956. Describes work done at Battelle on fabrication and properties of reactor materials, developed and evaluation of components, processing of feed materials, and other studies. ***Russell W. Dayton and Clyde R. Tipton, Jr.*** U. S. Atomic Energy Commission, *BMI-1152,* Jan. 1, 1957, 86 pp. (OTS $0.55).

Progress on Ceramic Coated Fuel Particles at Battelle. Discusses status of work on fabrication of coated particles, and preparation and in-pile testing of fuel elements. ***W. S. Diethorn, et al.*** U. S. *Atomic Energy Commission, BMI-1468,* Sept. 16, 1960, 32 pp. (OTS $0.75).

Factors Affecting the Ductility of Iron-Chromium-Aluminum Alloy Sheet. An evaluation of induction-melting and fabrication procedures for the iron-25 w/o aluminum alloy and the use of yttrium, niobium, and titanium as grain refiners in the alloy was undertaken. Copper, nitrogen, and probably silicon, present in starting materials, were found to be detrimental to bend ductility. Yttrium and combined niobium-carbon additives to the iron-chromium-aluminum alloy reduced both grain size and grain growth, but these additives did not improve ductility. Titanium acted only as an embrittling contaminant. ***Roy W. Endebrock, Ellis L. Foster, Jr., and Ronald F. Dickerson.*** U. S. Atomic Energy Commission, *BMI-1450,* July 7, 1960, 24 pp. (OTS $0.75).

Design Information on PH 15-7 Mo Stainless Steel for Aircraft and Missiles. Summarizes design information. Welding problems are discussed briefly. Data on the elevated-temperature mechanical properties of this alloy are collected and evaluated. The presentation and evaluation of these data are in accordance with procedures employed by the ANC-5 Committee. ***R. J. Favor, O. L. Deel, and W. P. Achbach.*** PB 151093; Defense Metals Information Center, *DMIC Report No. 135,* Aug. 22, 1960, 43 pp. (OTS $1.25).

Design Information on Nickel-Base Alloys for Aircraft and Missiles. Tensile, compressive, shear, and bearing properties of some nickel-base alloys for aircraft and missiles were assembled and evaluated. Tentative design curves showing the effect of temperature on these properties are presented. In addition to the mechanical-property data, background information on these alloys is presented to aid in the selection of alloys for given elevated-temperature applications. ***R. J. Favor, D. A. Roberts, and W. P. Achbach.*** PB 151090; Defense Metals Information Center, *DMIC Report No. 132,* July 20, 1960, 153 pp. (OTS $3.00).

Development of Methods and Instruments for Mechanical Evaluation of Refractory Materials at Very High Temperatures. A mechanical-testing system was established which is capable of providing tensile and compressive stress-strain data and shear-strength data up to 400 F in vacuum. The results of

an evaluation of the system using a molybdenum-0.5% titanium alloy in the bar form are presented. Tension, compression, shear and bearing tests were conducted at temperatures up to 3500 F. With the objective of developing equipment and technique for use to 6000 F or higher, problems to be solved in order that accurate data will be obtained are considered. Recommendations are made concerning furnace design, temperature and strain measurement, and specimen, grip and loading design. In particular, the probable advantages of graphite heaters coated with tantalum carbide are pointed out. ***D. H. Fisher, D. N. Gideon, et al.*** PB 171012; U. S. Air Force, Wright Air Development Division, *WADD Technical Report* 60-155, June 1960, 82 pp. (OTS $2.25).

A Comparison of Two Estimates of the Thorium Content of the Conway Granite, New Hampshire. Compares methods for determining thorium in the parts-per-million range. Gamma-scintillation spectroscopy and alpha-counting methods are compared with an indirect Th estimate where U is determined fluorimetrically, potassium by precipitation with tetraphenyl boron, and thorium colorimetrically with thoron as a reagent. In the example given the overage difference between the two methods is 0.25 ppm. based on values found from 16 samples. ***F. J. Flanagan, W. L. Smith, and A. M. Sherwood.*** *U. S. Geological Survey Professional* Paper 400-B, 1960, p. B168-B169.

Informative Abstracts on Magnetostriction in Cobalt and Cobalt Alloys. Covers work published through 1959 on compositions, structures, applications, and effects of various factors on mechanical and magnetic characteristics. ***Ellis Fletcher.*** Cobalt Information Center, Battelle Memorial Institute. 60 pp.

Experiments to Determine the Radiation Stability of UN Dispersions in Stainless Steel. A controlled radiation experiment was performed to determine the stability of fuel containing 28 w/o UN dispersed in and clad with Type 318 stainless steel as compared with fuel containing 30 w/o UO_2 dispersed in the same material. The specimens withstood irradiation at temperatures of 1500 to 2000 F and at burnups of 3.5 to 5.0 a/o of the uranium-235 at least as well as the UO_2 dispersions. These conclusions indicate the potential of UN as a high-temperature fuel; however, it is also obvious that many additional radiation experiments are required. ***David G. Freas, James H. Saling, John E. Gates, and Ronald F. Dickerson.*** U. S. Atomic Energy Commission, *BMI-1446*, June 14, 1960, 29 pp. (OTS $0.75).

High-Temperature Compatibility of Al_2O_3-, BeO-, and Metal-Coated UO_2 Particles With Graphite and Coke. As expected, the 2 to 8-μ metal coatings were badly damaged by reaction with carbon at temperatures as low as 1700 F. Both oxide coatings were completely destroyed after 6 hr at 3000 F. Considerable reaction between the matrices and Al_2O_3 and BeO coatings occurred during 1000 hr at 2500 F. Coating damage was more severe in surface particles than in particles located inside the the specimens. The graphite filler and pitch binder combination used in this study was less reactive than combinations containing coke filler or resin binder. ***Arnold F. Gerds and Allison K. Smalley.*** *U. S. Atomic Energy Commission, BMI-1479*, Nov. 28, 1960, 24 pp. (OTS $0.75).

Experimental and Research Work on Neutron Dosimetry. The effects of dose rate on the sensitivity to fast-neutron radiation of the experimental silicon-rectifier dosimeters were compared by exposing two sets of units to like amounts of radiation from the General Atomic TRIGA Reactor and the Battelle Research Reactor. No significant dependence of device characteristics on the rate of irradiation was observed. Information was obtained on radiation-induced changes in lifetime and, consequently, on the current-voltage characteristics of the experimental units. Two types of read-out circuits were developed, one of which employs the radiation-induced change in forward current at a fixed voltage and the other radiation-induced changes in lifetime. ***H. C. Gorton, O. J. Mengali, et al.*** PB 149378; *Quarterly Progress Report No. 3*, February 15, 1960, 30 pp. (LC mi $2.70, ph $4.80).

Radiative Recombination in Gallium Phosphide Point-Contact Diodes. The energy spectrum of the recombination radiation was measured using an arrangement of a diffraction grating and a 35-mm. camera. The peak density and minimum energy values correlate with those published by Wolff et al. A correlation between the onset of luminescence at isolated points in the breakdown region and discontinuities in the slope of the reverse characteristic was observed. ***H. C. Gorton, J. M. Swartz, and C. S. Peet.*** *Nature*, v. 188, Oct. 22, 1960, p. 303-304.

The Behaviour of Solvents and Binding Matter in the Electrostatic-Field. In order to gain an insight into the behavior of varnishes and surface coatings, including dropping velocities, drop magnitudes and spray angles with changing potentials, and surface tensions, conductivities and dielectric constants of varnish and resin solutions were determined. With the help of evaluations of the data illustrated graphically, it is possible to determine the composition of the surface coating which is most suitable for electrostatic spray. (*In German.*) Das Verhalten von Lösungsmitteln und Bindemitteln im elektrostatischen Feld. ***R. Grossteinbeck.*** *Fette, Seifen, Antrichmittel*, v. 62, no. 4, April, 1960, p. 318-326.

An Observation Concerning the Cycle Ratio in Cumulative Damage. Points out some inferences from consideration of the progress of fatigue damage in two steps—damage leading to crack initiation and damage of crack propagation. The physical picture on which the inferences are based can provide some guidance concerning the probable conservativeness or unconservativeness of applying the Miner relation in design for a specific set of circumstances. ***Horace J. Grover.*** Paper from Symposium on Fatigue of Aircraft Structures, *Special Technical Publication No. 274*, p. 120-124, 1959. American Society for Testing Materials.

Investigation of Feldspar in the High-Temperature Microscope. On heating a pressed compact of ceramic material there is a change in size and, at sufficiently high temperatures, also in shape. This change depends upon the material used, the rate of heating, and the sample preparation. It can be followed in the high-temperature microscope and the height of the sample may be plotted against temperature. Such investigations on feldspars and other ceramic materials are reported. (*In German.*) Zur Untersuchung von Feldspaten im Erhitzungs mikroskop. ***D. Harkort and D. Paetsch.*** *Berichte der Deutschen Keramischen Gesellschaft e. V.*, v. 37, no. 9, 1960, p. 402-409.

Investigation of Some Glasses for High-Level Gamma-Radiation Dosimeters. Several glass system were evaluated as dosimeters to measure integrated doses in the range from 10^6 to 10^9 rads by measuring optical density as a function of radiation dose. The two more promising glasses of those studied were Corning's Code 8392 and a special high-antimony glass. The maximum dosage that can be measured with these two glasses has not yet been determined. In exposures up to 3×10^8 rads, there was continuous increase in optical density with dose, and no evidence of saturation at the highest doses used. Glasses also were prepared that darkened only slightly at dosages up to about 8.7×10^7 rads. Such glasses may have utility for measuring dosages above 10^8 rads. ***W. A. Hedden, J. F. Kircher, and B. W. King.*** *American Ceramic Society, Journal*, v. 43 no. 8, Aug. 1960, p. 413-415.

Negative-Reactivity Measurements. Negative-reactivity measurements are frequently made by the red-drop and source-jerk techniques. Analysis of the data from such experiments by the usual methods requires measurement of the flux-time curve during a transient. Two alternative methods of obtaining negative reactivities are presented here. Neither of these methods requires measurement of a flux transient. Experimental results using these methods are given. ***William S. Hogan.*** *Nuclear Science and Engineering*, v. 8, Dec. 1960, p. 518-522.

Strain Aging of Refractory Metals. The available data on strain-aging behavior of V, Cb, Ta, Cr, Mo, W, Ru, Rh, Pd, Os, Ir, and Pt are reviewed and interpreted in terms of dislocation models. ***A. G. Imgram.*** PB 151092; Defense Metals Information Center, *DMIC Report No. 134*, Aug. 12, 1960, 64 pp. (OTS $1.75).

When You Need Alloys for Precision Resistors. Discusses important factors to consider and how some of the best known alloys compare with each other. ***C. M. Jackson and J. G.***

Dunleavy. *Materials in Design Engineering*, v. 52, no. 2, Aug. 1960, p .121-123.

A Study of the Titanium-Liquid Oxygen Pyrophoric Reaction. A review of the literature indicates that Ti is impact sensitive under liquid O below the acceptable limit for other metals. An experimental program was begun to determine the mechanism of the titanium-LOX reaction. Several factors were investigated singly in a controlled manner using unalloyed Ti(75A) and an alloy (6Al-4v) that were carefully cleaned. The factors were: exposure of a fresh surface by fracture and tearing; deformation by impact using steel balls; impact of smooth specially cleaned flat surfaces; LOX pressure and velocity; galling. The results from this program indicate that no one of the above, per se, is a primary cause of this reaction. ***J. D. Jackson, P. D. Miller, et al.*** PB 171017; U. S. Air Force, Wright Air Development Division, *WADD Technical Report* 60-258, June 1960, 59 pp. (OTS $1.50).

Refractory Materials. Surveys 122 refractory materials including graphite, 12 refractory metals, 18 carbides, 13 oxides, 12 nitrides, 17 silicides, 19 borides, 22 sulfides, and 8 intermetallic compounds. Availability, extraction, processing consolidation, fabrication, stability, mechanical behavior at low and high temperatures, physical properties, and thermal stresses are discussed. ***R. I. Jaffee and D. J. Maykuth.*** PB 161194; Defense Metals Information Center, *DMIC Memorandum* 44, Feb. 26, 1960, 32 pp. (OTS $0.50).

Development of Refractory Metal Sheet in the United States. Extensive programs were conducted on the metallurgy of Mo. More recently a series of programs was initiated on Cb, W, and Ta. Describes the status of the technical development of sheet alloys of these materials from the standpoint of the users and the producers and the refractory metals sheet rolling program. ***R. I. Jaffee, W. J. Harris, Jr., and N. E. Promisel.*** PB 161217; Defense Metals Information Center, *DMIC Memorandum* 67, Sept. 20, 1960, 12 pp. (OTS $0.50).

Characteristic Infrared Frequencies of 3,3-Diphenylphthalides in the Region of 2000 to 330 Cm^{-1}. The infrared spectra of ten 3,3-bis(phenyl)-phthalides were obtained in order to select frequencies characteristic of the phthalide ring system, and to observe the effects of phenyl substitution in the 3 position of the phthalide ring system. Bands characteristic of the phethalide ring system *per se* were observed near 1284 cm^{-1}, 1107 cm^{-1}, 503 cm^{-1}, and 479 cm^{-1}. Bands characteristics of 3,3-bis(phenyl)-phthalides were seen near 632 cm^{-1}, 530 cm^{-1}, and 370 cm^{-1}. The effect of substituents on the 3,3-phenyl rings upon frequency was noted for several bands; bands characteristic of these substituents were also observed. These data indicate that the various bands can be used for identification of the 3,3-bis(phenyl)-phthalide structure. ***R. J. Jakobsen and R. E. Wyant.*** *Applied Spectroscopy*, v. 14, no. 3, 1960, p. 61-63.

The Preparation of Diborane by the Calcium Hydride-Boron Halide Reaction. Diborane can be prepared from the reaction of calcium hydride and boron trifluoride. However, the yield and conditions for promoting the reaction are poor in comparison to preparations involving lithium hydride or sodium hydride. The results indicate the vast difference in reactivity between calcium hydride and sodium or lithium hydride. ***L. Levy, J. B. Vetrano, D. E. Trent, and J. F. Foster.*** *Journal of Inorganic and Nuclear Chemistry*, v. 13, 1960, p. 326-328.

New Beta Heat-Treating Salt Baths for Reducing Hydrogen Pickup by Uranium Rods. Hydrogen pickup by uranium was studied in different salt mixtures at 1350 F under dry and wet atmospheres. Laboratory-scale work showed that of the salts investigated, 50 w/o KCL-50 w/o NaCl and 50 w/o KCL-50 w/o Na_2CO_3 gave the best results from the standpoint of low hydrogen pickup, corrosion of uranium, and salt stability at 1350 F. Preliminary studies of corrosion of materials of construction in the pilot-plant-scale baths indicated that Type 330 stainless steel was more resistant to attack than mild steel and Types 304, 416, and 446 stainless steels. ***Lawrence L. Lortscher, Karl A. Sense, and Robert B. Filbert, Jr.*** U. S. Atomic *Energy Commission, BMI-1195*, June 1957, 31 pp. (OTS $0.40).

The Determination of Oxygen, Nitroben, Hydrogen, and Carbon in Molybdenum, Tungsten, Columbium, and Tantalium. Presents a summary of information available to the Defense Metals Information Center, as of Jan., 1960. The determinations of the interstitials are most conveniently discussed when considered as to the interstitial element sought. ***Manley W. Mallett.*** PB 161199; Defense Metals Information Center, *DMIC Memorandum* 49, Mar. 31, 1960, 16 pp. (OTS $0.50).

An Investigation of the Effects of Solute Elements on Magnetoelastic Damping and Coercivity in Very Pure Iron. Data are presented showing the time and temperature dependence of the damping in zone-melted iron containing small amounts of C. The differences in the damping of magnetized and unmagnetized specimens are assumed to represent the magnetoelastic contribution to the damping. The magnetoelastic contribution increases with increasing temperature in the vicinity of the Snoek peak, shifting the temperature and distorting the shape of this peak. Relaxation times calculated for this "magnetoelastic aftereffect" are in excellent agreement with those associated with the interstitial diffusion of carbon in alpha iron. ***R. E. Maringer and C. K. Manning.*** PB 149865; *Summary Report*, October 1, 1959, 24 pp. (LC mi $2.70, ph $2.70, ph $4.80).

A Proposal for Calculation of Thermodynamic Properties of He^3. Formal expressions are given for the average number of particles and the average energy of a system of interacting particles. Simpler expressions for these quantities, which are more amenable to calculation, are obtained as approximations. A self-consistent procedure for calculating these quantities at a given temperature and chemical potential is discussed. ***R. E. Mills, and R. L. Mills.*** Paper from *Helium Three*, p. 78-80, 1960. Ohio State University Press, Columbus, Ohio.

Studies of Hot Cracking in High-Strength Weld Metals. Use of freezing-cycle hot-tension machine indicates combined sulfur-phosphorous content below 0.025% prevents hot cracking. ***H. W. Mishler, R. E. Monroe, and P. J. Reippel.*** *Welding Journal*, v. 40, Jan. 1961, p. 1s-7s.

Retention of Aerosol Particles in the Respiratory Tract. Experimental and theoretic results show a minimum of retention in the 0.4 to 0.6μ range. Data also indicate 90% or more retention of particles greater than 7μ. In addition to particle size, the next largest variable affecting retention is breathing rate. The use of radioactive sodium chloride to obtain an approximation of alveolar retention gives an excellent measurement for therapeutic application of aerosols in the smaller branches, bronchioles, and alveoli. ***R. I. Mitchell.*** *American Review of Respiratory Diseases*, v. 82, no. 5, Nov. 1960, p. 627-639.

Determination of the Causes of Weld-Metal Cracking in High-Strength Steels and the Development of Heat-Treatable Low-Alloy-Steel Filler Wires for Use With the Inert-Gas-Shielded Arc-Welding Process. Freezing-cycle hot-tension studies were made on various heats of SAE 4340 steel containing various sulfur and phosphorus contents. Results indicated that the combined sulfur and phosphorus contents of SAE 4340 steel should be kept below 0.025% to prevent weld metal hot cracking. An integranular phase believed to be associated with hot cracking was found during light and electron microscopy of high-phosphorus SAE 4340 steels. This phase was tentatively identified as the iron-iron phosphide euctectic. Two new restrained weld-metal-cracking tests were developed that will give a quantitative measure of weld-metal-cracking resistance and which also will be inexpensive to conduct. Filler wires were developed which can produce weld metals capable of being heat treated to various strength levels in the range of 225,000 to 280,000 psi ultimate tensile strength. ***Herbert W. Mishler, Robert E. Monroe, and Perry J. Rieppel.*** PB 161981; U. S. Air Force, Wright Air Development Center, *WADC Technical Report* 59-531, May 1960, 60 pp. (OTS $1.50).

The Bonding of Molybdenum- and Niobium-Clad Fuel Elements. A solid-state bonding technique involving the use of gas pressure at elevated temperatures was utilized for the self-bonding of molybdenum and niobium. Bonding conditions and surface preparation as a function of the integrity of the bond

achieved were evaluated for each material. Optimum self-bonding of niobium was achieved by bonding parameters of 2100 to 2300 F at 10,000 psi for 3 hr with surfaces which had been prepared by etching in a nitric-hydrofluoric acid solution prior to bonding. Molybdenum self-bonding was most readily achieved by gas-pressure bonding at temperatures of 2300 to 2600 F at 10,000 psi for periods of 3 hr. ***S. J. Paprocki, E. S. Hodge, and P. J. Gripshover.*** U. S. Atomic Energy Commission, *BMI-1451*, July 12, 1960. (OTS $1.50).

Compacting Metal Powders With Explosives. Surveys materials, methods, structures and properties attainable, and future potentials. ***S. W. Porembka and C. C. Simons.*** SP60 - 102; Paper from "Creative Manufacturing Seminars, 1960-1961", 10 pp., 1960. American Society of Tool and Manufacturing Engineers, Detroit, Mich.

The Evaluation of the Effects of Very Low Temperatures on the Properties of Aircraft and Missile Metals. Presents the tensile and hardness properties of eight different alloys of interest to the aircraft and missile industries at temperatures ranging from -253 C (liquid hydrogen) to room temperature. These alloys are Ti-6Al-4V, Ti-5Al-3Mo-1V, Ti-16V-2.5Al, and B-120VCA (all-beta alloy) titanium alloys; 17-7PH, PH15-7Mo, and Type 301XH stainless steels; and Vascojet 1000 alloy steel. In general, the values for hardness, elastic modulus, and tensile and yield strengths of these materials tended to increase as the test temperature was reduced to -253 C. However, of the eight alloys investigated, the Ti-6Al-4V and the Ti-4Al-3Mo-1V titanium alloys and the Type 301 XH stainless steel were the only ones that did not reveal a serious loss of ductility or did not fracture before reaching 0.2% offset strain at -253 C. ***Leonard P. Rice, James E. Campbell, and Ward F. Simmons.*** PB 171016; U. S. Air Force, Wright Air Development Division, *WADD Technical Report* 60-254, June 1960, 61 pp. (OTS $1.75).

New Developments in the Welding of Metals. Describes progress made with new methods of welding metals. The applications and limitations of fusion welding, resistance welding, brazing, solid-state bonding, and plasma jet cutting and coating are discussed, along with brief descriptions of how the process works and what was done with it. ***P. J. Rieppel.*** PB 151089; Defense Metals Information Center, *DMIC Report No. 131*, June 24, 1960, 48 pp. (OTS $1.25).

New Developments in the Welding of Metals. The applications and limitations new processes are discussed, along with brief descriptions of how each process works and what has been done with it. The developments included are: (1) fusion welding: electroslag, short-arc and dip-arc, electron beam, arc spot; (2) resistance welding: high frequency, foil seam, magnetic force, process controls; (3) brazing; (4) solid-state bonding: ultrasonic, friction, diffusion, explosive; (5) cutting and coating (plasma Jet). ***P. J. Rieppel.*** PB 151089; Defense Metals Information Center, *DMIC Report No. 131*, June 24, 1960, 50 pp. (OTS $1.25).

The Effect of Rate of Heating to Aging Temperature on the Tensile Properties of Ti-2, 5Al-16V Alloy Sheet. The experiment described in this memorandum was designed to correlate tensile properties of aged Ti-2, 5Al-16V alloy sheet, heated to aging temperature at various rates, with the quench and reheat time-temperature-transformation diagram developed for this alloy by the Armour Research Foundation. Specially, the effects of three variables on aged strength and elongation were studied: the effect of rate of heating to aging temperature; the effect of minor variations in total time during aging; the effect of low-temperature pre-aging treatment to obtain omega phase. ***G. S. Root and H. R. Ogden.*** PB 161212; Deefnse Metals Information Center, *DMIC Memorandum* 62, Aug. 18, 1960, 11 pp. (OTS $0.50).

A Comparison of Lubricants and Coatings for Cold Extruding Titanium. Investigations were conducted on a number of surface coatings and lubricants, both experimental and commerical, as part of an over-all process development program on cold extrusion of solid and hollow titanium shapes. Materials were evaluated on the basis of surface finish and extrusion pressure in cold forward extrusion of unalloyed titanium billets 1½-in. in diameter to solid round bars 0.95 in. in diameter (60% reduction). A fluoride-phosphate chemical conversion coating proved to be most desirable from the standpoint of adherence, ease of application and cost. The effectiveness of the coating in reducing extrusion pressure and producing a good surface finish was dependent on the lubricant used. Various types and combinations of lubricants, including graphite, molybdenum disulfied, boron nitride, wax, soaps, polyalkylene glycol, and sulfochlorinated mineral oil were used in conjunction with the coating. The solid films, wax and soaps were both alone and suspended in several resin carriers. Of the various classes of materials, the solid-film lubricants produced the best surface finishes on the extruded bars. ***Alvin M. Sabroff and Paul D. Frost.*** *American Society of Lubrication Engineers Transactions*, v. 3, no. 1, Apr. 1960, p. 61-68.

Cobalt Oxides as Catalysts for the Complete Combustion of Automobile Exhaust Gases. With the aid of cobalt oxide oxide catalysts, it is possible to achieve a good conversion of the unburnt constituents of exhaust gases from gasoline engines for long periods of service, before the catalyst is spent. Long-duration tests carried out on unsupported and $CaAl_2O_4$-supported Co_3O_4 gave very promising results so far as conversion efficiency, ignition power and resistance to lead poisoning are concerned. Both these materials were prepared by decomposition of cobalt nitrate; their specific surface area is rather low. ***Herbert Schachner.*** *Cobalt*, no. 9, Dec. 1960, p. 12-21.

Electrodeposition of Chromium Alloys and Study of Elevated-Temperature Properties of Certain Electrodeposited Metals and Alloys. The objectives of the work during this report period were as follows: (1) to study the density and structure of the diffusion alloy of nickel-chromium electroplates; (2) to measure the oxidation of this diffusion alloy at 980 C in air and in liquid molybdenum trioxide; (3) to compare the changes in density resulting from heat treating nickel-chromium laminate, nickel plate from an all-chloride bath, watts-type nickel, low-contraction chromium, and Crack Free chromium; (4) to apply the diffusion alloy to molybdenum disilicide-coated molybdenum specimens; and (5) to investigate the adherence of chromium-iron alloy plate on steel. ***C. H. Schaer, J. A. Gurklis, et al.*** PB 148738; *Technical Progress Report No. 7*, August 15, 1955, 38 pp. (LC mi $3.00, ph $6.30).

Electrodeposition of Chromium Alloys and Study of Elevated Temperature Properties of Certain Electrodeposited Metals and Alloys. One of the objectives of the work during this period was to determine whether alternate layers of nickel and chromium plate could be diffused at 100 or 1150 C to form nickel-chromium alloy. A second objective was to confirm the superiority of stress-free Ni plate over stressed Ni plate as regards denseness after heat treatment. A third objective was to compare alloy plates. ***G. R. Schaer, P. T. Woodberry, et al.*** PB 148737; *Technical Progress Report No. 6*, June 15, 1955, 21 pp. (LC mi $2.70, ph $4.80).

Tantalum and Tantalum Alloys. A description literature survey was made covering physical properties, process metallurgy, binary and ternary alloy systems, chemical properties and metallurgical properties. Tantalum has only moderate strength at room temperature; however, the elevated-temperature strength decreases slowly in comparison with that of many other metals. The low ductile-to-brittle behavior, excellent fabricability, high melting point, and high solubility for interstitial and substitutional elements make tantalum an attractive candidate for use in high-temperature high-strength alloys. Refractory metals that exhibit brittle behavior at room temperature, such as molybdenum and tungsten, can be alloyed with tantalum to form tantalum-base alloys with a combination of high-temperature strength and low-temperature ductility not found in many metallice materials designed for ultra-high temperature service. ***F. F. Schmidt.*** PB 151091; Defense Metals Information Center, *DMIC Report No. 133*, July 25, 1960, 334 pp. (OTS $5.00).

A Tracer Technique to Measure Deposition of Stack Emissions. Indicates that the trace technique is a useful tool in the quantitative measurement of the particulate deposition rate of industrial emission. The variable decompositions of uranine

solutions exposed to the atmosphere in dust-fall containers prevents the use of dust-fall jars as sampling devices. Based on the laboratory study, uranine can be dispersed as a tracer into stack at stack-gas temperatures up to 600 F without decomposition. With direct stack injection, losses of tracer in the stack must be determined for each application. In using uranine it is mandatory that background fluorescence be determined in the area to be investigated. However, the technique is not limited to uranine. Any soluble material that satisfies the requirements of a tracer can be employed with this method. ***E. J. Schulz, R. A. Duffee, R. I. Michell, and E. W. Ungar.*** *American Industrial Hygiene Association Journal*, v. 21, no. 5, Oct. 1960, p. 343-349.

The Microscopic Determination of the Thickness and Platelets in Fine Materials. A procedure was developed for the direct microscopic determination of the thickness and planeness of both opaque and nonopaque platelets which constitute fine powders ranging from a limiting size of 100 mesh to a nominal size of 5 microns. The procedure consists of orienting the platelets by dusting the sample over the meniscus of an epoxy resin, sectioning the resultant catalyzed resin mount normal to the meniscus and, correspondingly the broad faces of the platelets, remounting the sectioned block in additional resin to protect the thin layer of oriented platelets, and polishing the sectioned face for microscopic examination in incident light. The possibility of extending this method to include the direct measurement of the thickness of platy clay-mineral particles by means of the electron microscope and replication methods is under study. ***Charles B. Sclar and Lee Dillinger.*** *American Mineralogist*, v. 45, 1960, p. 862-870.

Characteristics Governing the Friction and Wear Behavior of Refractory Materials for High-Temperature Seals and Bearings. An investigation of the basic factors involved in the wear and friction of ceramics, cermets, and high-temperature alloys sliding at speeds of 100 to 200 fps and temperatures from 500 to 1000 C (1000 F to 1800 C) was made. Bearing pressures covered a range of 5 to 50 psi. Statistical correlation of measured wear rates with friction and material properties indicates that, at these temperatures, the wear rate of ceramics and cermets is proportional to $\mu^{1.25}D^{0.75}$, where μ is the coefficient of friction, R is the thermal-stress-resistance factor, and D is the thermal diffusivity of the material on which wear predominates, which is usually the material with the lowest thermal-stress resistance. Promising commercial materials for high-temperature dry sliding bearings, gas bearings, and seals include Al_2O_3-Cr-Mo cermets, SiC ceramics, and TiC-Mo cermets. ***Lewis B. Sibley, Arthur M. Mace, Daniel R. Grieser, and C. Malcolm Allen.*** PB 171010; U. S. Air Force, Wright Air Development Division, *WADD Technical Report 60-54*, May 1960, 47 pp. (OTS $1.50).

New Methods for Creep Testing. After describing the methods for long-time extrapolation of creep curves, examines the Larsen-Miller method, determining the constant's value as a function of temperature, stress and time up to the breaking point. This constant between 15 and 30 for the same alloy. Larsen-Miller and Glen methods are compared and newly developed extrapolation methods are given. (*In French.*) Nouvelles methodes d'approche des problemes poses par les essais de fluage. ***W. Siegfried.*** *Metallurgia Italian*, v. 52, Oct. 1960, p. 640-646.

Welding Tantalum for High-Temperature Systems. Porosity in tantalum welds depends on the relation between the carbon and oxygen content of the base metal. Ultrasonic vibration reduces grain size in welds but its application may be limited by difficulties in coupling the power source to the work. ***S. M. Silverstein, J. N. Antonevich, R. P. Sopher, and P. J. Rieppel.*** *Metal Progress*, v. 77, no. 6, June 1960, p. 103-109.

Measurement of Thermal Conductivity by Utilization of the Peltier Effect. II. Correction for Wire Radiation and Determination of Specimen Radiation Emissivity. The analysis in the first article on measurement of thermal conductivity by utilization of the Peltier effect (T. C. Harman, J. H. Cahn, and M. J. Logan, J. Appl. Phys. 30, (1959)) is extended to correct for radiation of heat from the lead wires. It is shown how the radiation emissivity of the semiconductor specimen can also be determined from the measured temperatures. ***R. Simon, R. T. Bate, and E. H. Lougher.*** *Journal of Applied Physics*, v. 31, Dec. 1960, pp. 2160-2164.

Some Refractory Uranium Compounds—Preparation and Properties. In a program on possible new compounds for nuclear fuels, the refractory uranium compounds UC, UC_2, UN, UB_2, and UBe_{13} were investigated. Methods of preparing these compounds and techniques for sintering them to densities of 90 per cent or greater are described. Thermal expansion and conductivity, and the rate of reactions of several of the compounds with water vapor, oxygen, and nitrogen at temperatures up to 500 C were investigated. ***M. J. Snyder and A. B. Tripler, Jr.*** Paper from Symposium on Materials in Nuclear Application, *Special Technical Publication No. 276*. p. 293-300, 1959. American Society for Testing Materials.

Literature Pertaining to the Art and Science of Oil Burning for Residential Applications. A review of technical literature and compilation of abstracts prepared as a guide to references for the use of research investigators and designers in the field of oil-burning equipment. Sixteen broad subject classifications are each prefaced by an introductory review and each contains brief abstracts of pertinent references. Included are such subjects as fuel-oil atomization, ignition, physics and chemistry of combustion, fuel-air mixing and recirculation, surface combustion, chimneys, equipment developments, and standards. Although primary emphasis is placed on low-capacity oil burners, much of the material applies broadly to combustion and to larger oil-burning equipment. The publication was compiled by Battelle Memorial Institute as part of a research study for the API Fuel Oil Committee. ***C. F. Speich and D. W. Locklin, compilers.*** *API Publication No. 1537*. 110 pp. Jan. 1960. American Petroleum Institute, New York. (TH7466.06 Am36.5L Ref.)

The Radiochemical Determination of Uranium Burnup. As the result of the growth of research and development in the past years on nuclear fuels, well over 20 groups throughout the country and now engaged in the determination of U-235 burnup on a routine basis. The purpose of this paper is to review the techniques used by these groups and to describe in some detail the most common approach, that of radiochemical analysis for a single fission product. ***Duane N. Sunderman.*** Paper from Symposium on Materials in Nuclear Application, *Special Technical Publication No. 276*, p. 3-8, 1959. American Society for Testing Materials.

Measuring the Release of Short-Lived Fission Gases During Capsule Irradiations. A method was developed in which helium passes over the fuel specimen and carries fission gases to a delay trap located close to the capsule. Short-lived fission gases decay in the trap and deposit long-lived daughters which are assayed by radiochemical methods after trap removal. In two demonstrations of the technique the radiochemical analyses have provided information on the rate of release of 1.7-sec xenon-141, 16-sec xenon-140, 3.9 min xenon-137, and 3.2-min krypton-89. The technique should find considerable application in the irradiation evaluation of fuel materials when it is necessary to determine the contribtuion short-lived fission gases make to the coolant-contamination problem. ***Charles W. Townley, Gilbert E. Raines, Ward S. Diethorn, and Duane N. Sunderman.*** U. S. Atomic Energy Commission, *BMI-1466*, Sept. 12, 1960, 10 pp. (OTS $0.50).

The Mechanism of Hardening in 17-7PH Stainless Steel. The unique hardening found in precipitation-hardening stainless steels was investigated both in commercial sheet alloys of 17-7PH and high-purity ferrite single crystals of Fe-17Cr-7Ni-2Al. Profuse precipitation of needle-shaped particles was responsible for maintaining the high hardness level in the aged crystals. Ordering was not detected by X-ray diffraction in severely quenched single crystals displayed superlattice reflections from chromium and nickel on the bcc lattice, suggesting that the particles are ordered. Neutron-diffraction data indicate that the precipitate has an ordered bcc structure with iron on one sublattice and chromium, nickel, and aluminum distributed on the other sublattice. ***E. E. Underwood, A. E. Austin, et al.*** PB 161 850; Report for May 15, 1959-May 14, 1960, on Kinetics of Internal Structural Changes, *WADD Technical Report 60 236*, June 1960, 54 pp. (OTS $1.50).

BATTELLE
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REVIEW

ABSTRACTS

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ADMINISTRATION AND PHILOSOPHY OF RESEARCH

Research Overhead. DuBridge and Kaplan exchange views on overhead payments for basic research in private universities. ***L. A. DuBridge.*** *Science*, v. 132, Dec. 9, 1960, p. 1746-1747.

The Role of Chemical Research in the University and in Industry. ***Eric Rideal.*** *Chemistry & Industry*, 1960, no. 49, Dec. 3, p. 1488-1491.

Scientific Progress and the Federal Government. Makes general recommendations, recommendations for universities, and for the Federal Government to indicate the lines of development which are urgent in the immediate future. *Science*, v. 132, Dec. 16, 1960, p. 1802-1815.

The Encouragement of Productive Research. Discusses qualifications essential in research workers. ***J. H. Chesters.*** *NML Technical Journal*, v. 2, no. 4, Nov. 1960, p. 24-26.

Organization of Scientific Research in Latin America. Reviews general tendencies of scientific research in Latin America. ***Bernardo Houssay.*** *Science*, v. 133, Jan. 6, 1961, p. 46 + 1 page.

Creativity in Research. Author offers valuable suggestions for the cosmetic research technician. ***Robert L. Goldemberg.*** *Drug and Cosmetic Industry*, v. 87, no. 6, Dec. 1960, p. 762 + 6 pages.

The Challenge of Effective Planning for Research. To integrate its scientific research into its over-all long-range plans, a company must: determine what it wants to do and what research it must carry out to accomplish these goals; forecast how various economic, technological, and sociological factors will affect its goals; develop a general strategic plan that will minimize major technological threats to the company and will increase to the fullest its technological opportunities; determine how large the total research program should be and how the individual research projects should be ranked on the basis of their contribution to the company's goals; balance the support given to each important segment of research and development. ***James B. Quinn.*** *Chemical and Engineering News*, v. 39, no. 2, Jan. 9, 1961, p. 78-84.

AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

* **Lift of a Two-Dimensional Cascade of Aerofoils.** A method is presented by means of which the lift coefficient of an arbitrary aerofoil in a two-dimensional cascade is obtained explicitly in terms of a number of cascade functions, whose values depend only on the cascade geometry. The method is based on Schlichting's theory. ***J. J. Wannenburg.*** *Aircraft Engineering*, v. 32, Dec. 1960, p. 350-355.

* **Approximate Formulae for Flutter Prediction.** On the basis of certain simplifying assumptions a general equation can be developed that provides an estimate of the flutter speed of a binary system. The equation includes aerodynamic stiffness derivatives. ***W. G. Molyneux.*** *Aircraft Engineering*, v. 32, Dec. 1960, p. 356-362.

Institute of Aerophysics Decennial Symposium, Oct. 14-16, 1959. Technical Sessions. Gasdynamics. Astronautics I-II. Proceedings, Pt. III. Gasdynamics with four articles, astronautics I with four articles, and astronautics II with three articles are discussed. 322 pp. 1959. Institute of Aerophysics, University of Toronto, Canada. (TL505 T63s Over.)

Institute of Aerophysics Decennial Symposium, Oct. 14-16, 1959. Proceedings, Pt. II. The jet flap and Stol, the deflection of two-dimensional jets, a lifting surface theory for wings with submerged fans and other problems are discussed.

* Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.

200 pp. 1959. Institute of Aerophysics, University of Toronto. (TL505 T63s Over.)

a * **Britain's Hovercraft Industry.** Experiment results are described. *Aeroplane and Astronautics*, v. 99, Dec. 9, 1960, p. 768-771.

b * **Vertical Flight Control by Pressure Altitude: A Revised System of Altimetry.** An altitude-indicating system for aircraft using pressure units only is presented. The pressure altitude indicator is proposed as a replacement for the conventional altimeter. The millibar is the proposed scale unit. Techniques for use are discussed. ***W. R. Fryers.*** *Canadian Aeronautical Journal*, v. 6, no. 10, Dec. 1960, p. 426-430.

c * **Future Uses of Space Vehicles.** Describes the uses to which space vehicles may be put in the next decade and covers both military and civil applications. ***K. J. Radford.*** *Canadian Aeronautical Journal*, v. 6, no. 10, Dec. 1960, p. 423-425.

d * **Methods of Measurement of Aircraft Dynamic Stability Derivatives.** The numerous methods available for determination of dynamic stability derivatives are presented and grouped according to a convenient classification system. Both free flight and wind tunnel methods are considered. ***K. J. Orlick-Rückemann.*** *Canadian Aeronautical Journal*, v. 6, no. 10, Dec. 1960, p. 414-422.

e **Extension of Boundary-Layer-Separation Criteria to a Mach Number of 6.5 by Utilizing Flat Plates With Forward-Facing Steps.** Examinations of the separated flow showed that the predominant variable in the determination of the pressure distribution was the location of transition relative to the separation point and reattachment. Pure laminar, transitional, and turbulent types of separation were found in this Mach number range. As the Mach number is increased, the peak pressure coefficient $C_{p,p}$ for turbulent separation decreased from approximately 0.18 at a Mach number of 4 to about 0.13 at a Mach number of 6.25. ***James R. Sterrett and James C. Emery.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-618, Dec. 1960, 52 pp. (TL570 Un3t Vis.)

f **An Analysis of the Flapwise Bending Frequencies and Mode Shapes of Rotor Blades Having Two Flapping Hinges to Reduce Vibration Levels.** The equations of motion are derived for a blade of variable mass and stiffness distribution. Solutions to the equations are presented. The results show that the natural frequencies of the blades can be changed appreciably by varying the locations of the blade hinges, and that with two properly located flapping hinges, blade designs are possible which eliminate or greatly reduce conditions of resonance between the blade natural frequencies and the frequencies of the harmonic air loads. ***George W. Brooks, and H. Wayne Leonard.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-633, Dec. 1960, 28 pp. (TL570 Un3t Vis.)

g **Osculating Elements Derived From the Modified Hansen's Theory for the Motion of an Artificial Satellite.** The modified Hansen's theory, which heretofore gave only the position vector of the satellite, is used herein for the derivation of the velocity vector and the osculating elements. Comparison with other general perturbation theories and with special perturbation techniques is now possible. ***A. Bailie and R. Bryant.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-568, Jan. 1961, 8 pp. (TL570 Un3t Room 290)

h * **Optimization of Airfoils for Hypersonic Flight.** The Kármán momentum integral for boundary-layer growth is cast into a form which permits an expression for the local skin friction at a particular point on a body to be derived in terms of an integral which depends on the distribution of body shape up to that point. A discussion of solutions to the minimization problem posed above subject to the constraint of fixed lift follows. Several interesting general conclusions may be drawn concerning the way in which lift must be distributed on a body for optimum drag when the Reynolds number is such that viscous drag is an appreciable fraction of the total drag. ***Coleman duP. Donaldson and K. Evan Gray.*** *Aero/Space Engineering*, v. 20, Jan. 1961, p. 18 + 7 pages.

i **A Study of Longitudinal Control Problems at Low and Negative Damping and Stability With Emphasis on Effects of Motion Cues.** An investigation was conducted in several types of simulators, including the Johnsville centrifuge, and in flight to assess the effects of incomplete or spurious motion cues on pilot opinion and task performance over a wide range of longitudinal short-period dynamics. Most of the tests were conducted with a conventional center stick; however, a brief evaluation in the centrifuge of a pencil-type side-arm controller was also made. ***Melvin Sadoff, Norman M. McFadden, and Donovan R. Heinle.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-348, Jan. 1961, 53 pp. (TL570 Un3t Room 290)

j **Recent Advances in Astrodynamics 1960.** Geometry and coordinate systems astrodynamic constants, orbit determination, the N-body problem, special and general perturbations, nongravitational and relativistic effects and other problems are discussed. ***Robert M. L. Baker, Jr.*** *ARS Journal*, v. 30, Dec. 1960, p. 1127-1140.

k **Minuteman Equipment Well Integrated.** Inspection shows little variation in systems for mobile and hardened versions; a close look at how missile's G&C functions. *Missiles and Rockets*, v. 8, no. 3, Jan. 16, 1961, p. 35-38.

Effects of Cone Angle, Mach Number, and Nose Blunting on Transition at Supersonic Speeds. Changes in Mach number had little effect on transition distance and transition Reynolds number for the near-sharp or very small bluntnesses. The effect of Mach number variation on the larger hemispherical bluntnesses was much stronger, with the strongest Mach number effect occurring for Mach numbers between 1.61 and 1.82. With an increase in nose radius, there was a strong decrease in transition distance and transition Reynolds number at the lower Mach numbers. ***K. R. Czarnecki and Mary W. Jackson.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-634, Jan. 1961, 31 pp. (TL570 Un3t Room 290)

Heat Transfer to Surfaces of Finite Catalytic Activity in Frozen Dissociated Hypersonic Flow. An integral method is used in a theoretical study of the heat transfer along the surface of two-dimensional and axisymmetric bodies with finite catalytic efficiencies. For the flat plate, a solution is derived, in closed form, which enables one to calculate catalytic heat transfer along the surface with and without mass transfer. The analysis of an axisymmetric conical body with a spherical nose shows that a simple solution based on a local similarity concept is in good agreement with the results of the more rigorous treatment. General implications of catalytic surface recombination in hypersonic heat transfer to blunt bodies flying at high altitudes are discussed. ***Paul M. Chung and Aemer D. Anderson.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-350, Jan. 1961, 36 pp. (TL570 Un3t Room 290)

* **Saturn . . Booster for the Sixties.** Hopes for man-in-space and planetary probes hinge on NASA's giant space vehicle; H-2 engine could boost 1st-stage thrust to 2.4 million lb. ***John P. Kushnerick.*** *Aircraft & Missiles*, v. 4, Jan. 1961, p. 17-23.

* **What We Need to Win Aerospace Race With Russia.** Seventh forecast of Aerospace Industries Association projects technological requirements for next decade; report based on consensus of key experts in industry. *Aircraft & Missiles*, v. 4, Jan. 1961, p. 35-41.

* **NASA's Goals for Next Decade.** Projected expenditure rate over $1.5 billion per year; standardization guides design of boosters and spacecraft, man's immediate role confined to near-Earth orbital flights. ***S. Peter Kaprielyan.*** *Aircraft & Missiles*, v. 4, Jan. 1961, p. 43-49.

* **The Difference Function Approach to the Overall Aerodynamics of Guided Missiles.** The fundamental assumption is that the over-all coefficients can be expressed sufficiently accurately as the sum of independent control effects and of the mutual interference between adjacent controls. This assumption has been found to be valid over quite wide regions of supersonic Mach number, body incidence and control deflection for some typical cruciform rear control missiles. In principle the method applies at all speeds and to all types of layout, but it seems likely to be less widely applicable at subsonic and transonic speeds and to moving wing and canard layouts. ***C. A. Forster and A. C. Southgate.*** *Royal Aeronautical Society, Journal*, v. 64, Dec. 1960, p. 753-763.

* **Helicopter Vibrations.** The cause of the stresses, the mathematical model, theoretical results, air screw flutter experiments, experimental confirmation, related experiments, and further investigations are discussed. ***J. P. Jones.*** *Royal Aeronautical Society, Journal*, v. 64, Dec. 1960, p. 743-752.

A Flight Investigation of an Automatic Gust-Alleviation System in a Transport Airplane. A gust-alleviation system designed to improve riding comfort has been investigated in flight. The system is capable of reducing the normal accelerations due to gusts by 50 to 60% and of simultaneously reducing the pitching velocities normally encountered in gusts by about 40%. The resulting improvement in riding comfort was quite impressive to the flight crew. ***Paul A. Hunter, Christopher C. Kraft, Jr., and William L. Alford.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-532, Jan. 1961, 91 pp. (TL570 Un3t Room 290)

Effect of Shield Position and Absorptivity on Temperature Distribution of a Body Shielded From Solar Radiation in Space. An analytical study of temperature distributions on two disks subjected to solar radiation was made. The effect on the temperature distribution of absorptivity, thermal conductivity, and the spacing between disks was determined. The calculations show the possibility of using a movable shield as a temperature control device for a space vehicle. ***Lester D. Nichols.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-578, Jan. 1961, 41 pp. (TL570 Un3t Room 290)

Experimental Investigation of a Hypersonic Glider Configuration at a Mach Number of 6 and at Full-Scale Reynolds Numbers. A hypersonic airplane configuration consisting of three triangular wing panels and a body of equal length is investigated in tests at a Mach number of 6 and at Reynolds numbers from 6 to 16 million by use of gun-launched models. Characteristics investigated included minimum drag with rough and smooth model surfaces, lift-curve slope, and static and dynamic stability. The results are used to evaluate theoretical estimates of the configuration performance. The methods used to estimate the performance are described. The extent of laminar flow on the models at full-scale Reynolds number is determined. ***Alvin Seiff and Max E. Wilkins.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-341, Jan. 1961, 69 pp. (TL570 Un3t Room 290)

A Three-Axis Fixed-Simulator Investigation of the Effects on Control Precision of Various Ways of Utilizing Rate Signals. A study was made of control of a vehicle with no inherent stability or damping. A side-arm controller providing proportional acceleration control was used. Vehicle rate signals were used to provide control feedback or system damping and were used in the instrument display either separate from or summed with displacement signals. Near optimum performance of both transitions in roll and control of system disturbance was obtained by using a combination of system damping and summed displacement signals and rate signals. ***John W. McKee.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-525, Jan. 1961, 54 pp. (TL570 Un3t Room 290)

Injection Schemes for Obtaining a Tweny-Four Hour Orbit. Analysis of some possible schemes for obtaining a 24-hr. orbit from a nonequatorial launch site, specifically, Cape Canaveral—schemes that are general and applicable to any desired longitude for the earth-fixed point in the orbit. The scheme should be as economical as possible, propellant-wise, and the involved flight times should be kept to a minimum at points of the scheme in which accuracy and accuracy of guidance equipment with time are critical. ***Rudolf F. Hoelker and Robert Silber.*** *Aero/Space Engineering*, v. 20, Jan. 1961, p. 28 + 9 pages.

V/STOL Cargo Airplane Characteristics. The commercial direct operating cost of the helicopter is less than that of the other VTOL configurations for ranges up to about 100 nautical miles; the weight is less for ranges up to 200 nautical miles. For ranges between 200 and 500 nautical miles, the weight of the unloaded rotor is less than that of the other configurations. This weight advantage is substantial if the mission hover requirement exceeds a few minutes. ***W. C. J. Garrard.*** *Aero/Space Engineering*, v. 20, Jan. 1961, p. 22 + 12 pages.

Ablation With Ice Model at M = 5.8. The possibility of an experimental study of aerodynamic ablation in moderate temperature wind tunnels is examined on the basis of available laminar boundary theories. With such materials as water ice, dry ice, naphthalene and camphor, a fairly wide range of important parameters of ablation phenomenon may be covered. An experiment was performed with a water ice, hemisphere-cylinder model in the GALCIT $M = 5.8$ wind tunnel at a supply temperature of 300 F, and the results show; that the ice melted around the stagnation point when the supply pressure was above 34 psia, and the ice sublimed everywhere on the model when the pressure was less than 34 psia. ***Toshi Kubota.*** *ARS Journal*, v. 30, Dec. 1960, p. 1164-1169.

AGRICULTURE

* **Analog-Synergism of Several Carbamate Insecticides.** Combinations of two carbamate insecticides applied jointly were found to increase mortality beyond the expected additive effect on two of the three insect species tested. Dimetilan was found to synergize the more potent *in vitro* cholinesterase inhibitors Sevin and Pyrolan on German cockroaches and house flies. ***H. T. Gordon and M. E. Eldefrawi.*** *Journal of Economic Entomology*, v. 53, no. 6, Dec. 1960, p. 1004-1009.

* **DDT Residues on New York Dairy Farms Following the Gypsy Moth Eradication Program.** Aerial-applied DDT-oil solutions for eradication of the gypsy moth, *Porthetria dispar* (L.), in 1957 were found to be highly persistent on forage and little affected by weathering. ***E. W. Huddleston, George G. Gyrisco, and D. J. Lisk.*** *Journal of Economic Entomology*, v. 53, no. 6, Dec. 1960, p. 1019-1021.

* **Interference With the Biological Control of Cottony-Cushion Scale by Insecticides and Attempts to Re-Establish a Favorable Natural Balance.** Biological control of the cottony-cushion scale, *Icerya purchasi Mask.*, by the vedalia beetle, *Rodolia cardinalis* (Muls.), in the desert citrus areas of California was upset so severely by insecticidal drift from surrounding treated areas that chemical control became necessary. Vedalia destruction is most often caused by drift of malathion, parathion, or DDT applied by airplane during the early spring months. ***B. R. Bartlett and C. F. Lagace.*** *Journal of Economic Entomology*, v. 53, no. 6, Dec. 1960, p. 1055-1058.

The Next 25 Years of Chemurgy. ***K. Starr Chester.*** *Chemurgic Digest*, v. 19, Nov. 1960, p. 8-11.

The Pharmaceutical Revolution Down on the Farm. The increasing participation of pharmaceuticals in the animal health and nutrition field is discussed. ***David Dachs.*** *Drug and Cosmetic Industry*, v. 87, no. 6, Dec. 1960, p. 766 + 6 pages.

Carotene and Tocopherol Content of Dehydrated and Sun-Cured Alfalfa Meals. ***L. W. Charkey, W. E. Pyke, Adeline Kano, and R. E. Carlson.*** *Journal of Agricultural and Food Chemistry*, v. 9, Jan.-Feb. 1961, p. 70-77.

Herbicide Structure and Stability—Effect of Chemical Structure on Microbial Decomposition of Aromatic Herbicides. The resistance of some aromatic herbicides or their derivatives to microbial degradation is governed by the position of the halogen on the aromatic nucleus and by the linkage and type of aliphatic side chain. ***M. Alexander and M. I. H. Aleem.*** *Journal of Agricultural and Food Chemistry*, v. 9, Jan.-Feb. 1961, p. 44-47.

BIOCHEMISTRY AND BIOPHYSICS

* **Action of Phospholipids on the Cytotoxic Effect of Rabbit Antibodies Against Ehrlich Ascites Tumour Cells.** The inhibition caused by the various materials (cephalins, cerebroside, proteolipid, phosphoserine, ethanolamine, Congo red and trypan blue) is effective only when the various inhibitors are preincubated with antiserum prior to the addition of cells. Since the inhibition is reversed by guinea pig serum it is assumed that the various inhibitors act on complement essential for the cytotoxic effect of the antisera. The possible role of phospho-

lipids as complement inhibitors and their relation to cytotoxic effects of immune reactions is discussed. ***I. Ginsburg.*** *British Journal of Experimental Pathology*, v. 41, no. 6, Dec. 1960, p. 648-659.

* **The Chemical Basis of the Virulence of *Pasteurella pestis*. III. An Immunogenic Product Obtained From *Past. pestis* Which Protects Both Guinea-Pigs and Mice.** A product was obtained from *Past. pestis* which immunized guinea pigs and accounted for the immunizing activity in this species of killed *Past. pestis* isolated directly from infected guinea pigs. The product was a relatively non-toxic residue—cell-wall material containing lipid, carbohydrate and protein—left after extraction of *Past. pestis* with ultrasonic waves. The authors suggest that the immunogenic residue is a relatively large fragment of a native cell wall—envelope complex which may be the best immunogen for all species. ***J. Keppie, E. C. Cocking, K. Witt, and H. Smith.*** *British Journal of Experimental Pathology*, v. 41, no. 6, Dec. 1960, p. 577-585 + 1 plate.

* **On Malignolipin. VII. Detection of Malignolipin in Blood of Human Subjects and Experimental Animals.** Concludes that the malignolipin is specific to malignant tumors irrespective of the kind of tumor or animal species, and that the blood malignolipin test is highly reliable in diagnosing malignant tumors, especially in their early stages of development. ***Takekazu Kôsaki, et al.*** *Japan Academy, Proceedings*, v. 36, no. 8, Oct. 1960, p. 516-520.

* **Similarity of Protein and Enzyme Patterns in Different Types of Malignant Tissues.** Soluble proteins extracted from different types of malignant tissues in mice were chromatographed on DEAE (diethylaminoethyl)-cellulose. All the tumors examined showed a very similar protein and enzyme pattern. ***P. U. Angeletti, B. W. Moore, and V. Suntzeff.*** *Cancer Research*, v. 20, no. 11, Dec. 1960, p. 1592-1596.

* **Clues to the Etiology, Pathology, and Therapy of Cancer Provided by Analogies With Transplantation Disease.** The hypothesis is developed that a malignant tumor arises from a single cell that has suffered loss or inactivation of a single gene, if in heterozygous condition, or of both alleles if homozygous. The relevant genes are considered to be those determining the formation of histocompatibility antigens. ***Albert Tyler.*** *U. S. National Cancer Institute, Journal*, v. 25, no. 6, Dec. 1960, p. 1197-1229.

* **Neoplasms Among A-Bomb Survivors in Hiroshima: First Report of the Research Committee on Tumor Statistics, Hiroshima City Medical Association, Hiroshima, Japan.** The 1957-1958 incidence of neoplasms among the survivors of the Hiroshima A-bomb varies directly with radiation dose, insofar as it may be inferred from distance from the hypocenter at exposure. The incidence of all malignant neoplasms among the survivors who were within 1000 meters is more than 4 times that of the nonexposed population. ***Tomin Harada and Morihiro Ishida.*** *U. S. National Cancer Institute, Journal*, v. 25, no. 6, Dec. 1960, p. 1253-1264.

* **Structural Differences Produced in Mammalian Cells by Changes in Their Environment.** Epidermal cells assume a different form and internal structure when they are cultured in tissue-culture medium containing protein or in medium without protein. Cells grown in protein medium produce characteristic lamellar bodies which appear to be derived from mitochondria. ***Max G. Menefee and Virginia J. Evans.*** *U. S. National Cancer Institute, Journal*, v. 25, no. 6, Dec. 1960, p. 1303-1310.

* **Serum-Protein Changes in Malignant Disease. II. The Chronic Leukemias, Hodgkin's Disease, and Malignant Melanoma.** Four malignant neoplasms were investigated and each showed differing changes in the serum proteins. The changes with each malignant disease depend, in part at least, on the stage of disease activity. The changes are described for each disease. ***Dane R. Boggs and John L. Fahey.*** *U. S. National Cancer Institute, Journal*, v. 25, no. 6, Dec. 1960, p. 1381-1390.

* **Importance of the Infecting Dose on Growth Patterns of Rous Sarcoma Virus (RSV) in Chick Brain.** The growth curves of Rous sarcoma virus (RSV) in chick brain paralleled those of many nononcogenic animal viruses only when large doses were used. It is suggested that the dependence of the pathogenesis of disease on the amount of RSV contained in the infecting dose represents a basic difference between at least one tumor virus and the nononcogenic viruses. ***Frank J. Rauscher and Vincent Groupé.*** *U. S. National Cancer Institute, Journal*, v. 25, no. 6, Dec. 1960, p. 1391-1404.

Protein Structure and Function. Report of Symposium Held June 6-8, 1960. Contains published reports of papers presented at Brookhaven Symposium on Biology, No. 13. Subjects discussed include disulfide and sulfhydryl groups in protein structure, noncovalent bonds in protein structure, deductions from hydrodynamic and thermodynamic measurements, deuterium exchange studies and protein structure, conformations of macromolecules, chemical modifications of ribonuclease, and peptide-protein interactions. *U. S. Atomic Energy Commission, BNL-608* (C30), Nov. 1960, 266 pp. (UF767 Un3.1bn Contin.)

The Origin of Life on Earth and Elsewhere. II. The synthesis of relatively complex organic molecules by ionizing and radical mechanisms from methane, ammonia, water, and hydrogen is described, both theoretically and experimentally. It is shown that the molecules which tend to be formed under such random conditions are the very ones which today are the common building blocks in the biological reconstruction of organic material. Such molecules are the amino acids, the simple carboxylic and hydroxy acids, purines, pyrimidines, etc. The appearance of order among such random molecules is induced by two forces, namely, autocatalysis and crystallization. The latter is particularly important in the appearance of highly efficient macromolecular structures and arrangements which are so characteristic of present-day living organisms. ***Melvin Calvin.*** *U. S. Atomic Energy Commission, UCRL-9440*, Oct. 19, 1960, 41 pp. (UF767 U3u Contin.)

* **Mutation-Causing Effects of Some Purine and Pyrimidine Compounds.** Adding adenosine, deoxyadenosine, thymidine or AMP, dAMP, TMP, to a medium containing spheroplasts from an auxotrophic strain of *E. coli* produces stable reversions. This would agree with the hypothesis of the capacity of a perturbation in the distribution of the precursors of the nucleic acids to cause mutations. (*In French.*) Action mutagène de quelques composés puriques et pyrimidiques. ***Francesco Feo, Christiane Quirin, Monique Jacob, and Paul Mandel.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 22, Nov. 28, 1960, p. 2608-2610.

* **Effects of Fragments and Extract of Lung Tissue on Corneal Epithelium Cultures.** In contact with lung tissue, the epithelial fragment is modified in thickness and organization. In mixed cultures, degeneration processes and mitotic abnormalities are increased. Simultaneous growth of the two tissues in contact is rare; most often the corneal epithelium grows. In the presence of lung fragments the growing epithelial cells have different dimensions and appearances. (*In French.*) Action de fragments et d'extrait de tissu pulmonaire sur des cultures d'épithélium cornéen. ***Raoul Michel May and Gisèle Mignot.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 22, Nov. 28, 1960, p. 2599-2601.

The Structure and Stabilization of the Collagen Macromolecule. Native collagen, solubilized in the cold by treatment with acidic buffers or neutral salt solutions, appears in solution as rigid, very asymmetric macromolecules, or as small degree-of-polymerization aggregates of such macromolecules. The dimensions of these macromolecules and their behavior upon thermal or enzymatic degradation are consistent with a content of three polypeptide chains arranged in a linear array. ***Peter H. von Hippel and William F. Harrington.*** *U. S. Atomic Energy Commission, BNL-608* (C-30), Nov. 1960, p. 213-231. (UF767 Un3.1bn Contin.)

* **Chemical Protection of the Alimentary Tract of Whole-Body X-Irradiated Mice. II. Chromosome Breaks and Mitotic Activity.** The number of chromosome fragments in the crypt cells of both treated and nontreated mice is dose dependent. In lethally X-irradiated mice given AET the number of chromosome fragments was less than that of nontreated mice; at supralethal X-ray doses, AET markedly protected mitotic activity. The data indicate that, in treated and nontreated mice, recovery of mitotic activity was inversely related to the number

of chromosome fragments. ***J. Maisin and J. Moutschen.*** *Experimental Cell Research*, v. 21, no. 2, Nov. 1960, p. 347-352.

Non-Covalent Bonds in Protein Structure. In addition to covalent bonds, hydrogen bonds, ionic bonds, and apolar bonds may contribute to the stabilization of protein configurations. Their relative contributions within proteins in aqueous solution are not easy to assess. Simple model systems, methylacetamide for hydrogen bonds and small anions and cations for ionic linkages, exist in water in the form of nonaggregated species except at very high concentrations. ***Irving M. Klotz.*** *U. S. Atomic Energy Commission, BNL-608* (C-30), Nov. 1960, p. 25-48. (UF767 Un3.1bn Contin.)

Active Fragments of Antibody. The author believes that with the methods at present available, solution of the complete structure of antibody molecules is not possible and, even if it were, it might leave us still ignorant of the particular structural features responsible for the special affinity of the antigen and their other biological properties. ***R. R. Porter.*** *U. S. Atomic Energy Commission, BNL-608* (C-30), Nov. 1960, p. 203-212. (UF767 Un3.1bn Contin.)

* **Infrared Spectra of the Three-Stranded Helices Formed by Polyuridylic Acid With Polyadenylic Acid and With Tetraadenylic Acid.** Results of measured spectra are cited. The results with the oligonucleotide constitutes additional evidence in support of the three-stranded structure for tetra A + 2 poly U^s. ***H. Todd Miles.*** *Biochimica et Biophysica Acta*, v. 45, no. 1, Dec. 4, 1960, p. 196-198.

* **Proceedings of the Symposium on Methods of Peptide Synthesis Held at Prague, September 1958.** The following were among the topics treated at the Symposium organized by the Chemical Institute of the Czechoslovak Academy of Science: activation of the carboxyl group for peptide synthesis; methods for the forming of peptide bonds, based on the activation of the amino acids; synthesis of optically active peptides from racemic amino acid esters; peptides of the hydroxy amino acids and special problems of cyclic peptide synthesis. (*In German and English.*) *Collection of Czechoslovak Chemical Communications*, (Special Issue), v. 24, 1959, 160 pp.

The Nucleic Acids. Contains papers on deoxyribonucleic acids as macromolecules, photochemistry of nucleic acids, chemical and enzymic synthesis of polynucleotides, chemistry of nucleic acids of microorganisms, the nucleic acids of the bacterial viruses, the ribonucleic acids of viruses, and biosynthesis of purine nucleotides and of pyridimidine nucleotides. ***Erwin Chargaff and J. N. Davidson, editors.*** v. III. 588 pp. 1960. Academic Press, New York. (QD341.A2 C37n)

* **Fluorescent Histiocytes in Sputum Related to Smoking.** Fluorescent histiocytes have been demonstrated in the sputum of cigarette smokers. Nonsmokers' sputum does not contain comparable fluorescence. The fluorescence may be due to the presence of polycyclic hydrocarbons, probably bound to the lipid in the histiocyte cytoplasm. ***Philips S. Vassar, Charles Culling, and A. M. Saunders.*** *Archives of Pathology*, v. 70, no. 6, Dec. 1960, p. 649-652.

Chromatoclasic Effect of Ethylene Oxide on the Purine and Pyrimidine Bases of Nucleic Acids. Tests revealed the high radiomimetric effect of ethylene oxide on chromosomes resulting in chromosomal fragmentation. (*In French.*) L'effet chromatoclasique de l'oxyde d'ethylene: action sur les bases puriques et pyrimidiques des acides nucléiques. ***J. André Thomas, Guy Deysson, and Jacques Cozette.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 23, Dec. 5, 1960, p. 2797-2799.

* **Biological Problems and Cosmic Flights.** Discusses the importance of determining the conditions of cosmic flight, the physical state of the cosmic expanse, the effects of flight on the human organism by the objective recording (including self-observation) of the physiological functions of the flyer, of his behavior and activity in the cosmic ship cabin, as well as the details and efficiency of systems for safe return to earth. (*In Russian.*) Problemy biologii i kosmicheskie polety. ***H. M. Sisakiana.*** *Akademiia Nauk SSSR, Vestnik*, v. 30, no. 11, Nov. 1960, p. 15-24.

A Possible Specific Chromosome Abnormality in Human Chronic Myeloid Leukaemia. ***A. G. Baikie, et al.*** *Nature*, v. 188, Dec. 31, 1960, p. 1165-1166.

Perception of Distance in Animal Echo-Location. ***Jan Nordmark.*** *Nature*, v. 188, Dec. 17, 1960, p. 1009-1010.

An Oncolytic Virus Recovered From Swiss Mice During Passage of an Ascites Tumour. The recovery of a tumor-destroying virus from mouse ascites was recently reported by Bennette. It was serially transmissible and seemingly non-pathogenic in the absence of neoplastic cells. An agent with strikingly similar properties has been under observation in the writers' laboratories for the past two years. ***John B. Nelson and George S. Tarnowski.*** *Nature*, v. 188, Dec. 3, 1960, p. 866-867.

* **Significance of Continued Virus Production in Tissue Cultures Rendered Neoplastic by Polyoma Virus.** An essential factor in the phenomenon of persistent virus release is the increased resistance of the neoplastic cells to superinfection by PY virus. In most transformed hamster cultures, the resistance is so high that no or very few virus-releasing cells arise upon superinfection; in transformed mouse embryo cultures, the resistance is weaker, and a few per cent of virus-yielding cells can be produced. ***Renato Dulbecco and Marguerite Vogt.*** *National Academy of Sciences, Proceedings*, v. 46, Dec. 1960, p. 1617-1623.

* **A Model of Growth and Growth Control in Mathematical Terms. II. Compensatory Organ Growth in the Adult.** The mathematical model for the major carrier wave of growth and growth control proposed by Weiss and Kavanau has been tested for the case of compensatory organ growth in the adult by employing an IBM 709 Digital Computer. Several sample solutions were determined; in all the cases, the compensatory growth curves for total mass are undulatory in character. This finding is consistent with observations on liver growth following partial hepatectomy in the rat. The model also reproduces the spurt of compensatory growth of an organ system following artificial mass reduction. ***J. Lee Kavanau.*** *National Academy of Sciences, Proceedings*, v. 46, Dec. 1960, p. 1658-1673.

Synthesis of Macromolecules Under Possible Primeval Earth Conditions. Different possible ways of synthesis of macromolecules are discussed. ***A. T. Wilson.*** *Nature*, v. 188, Dec. 17, 1960, p. 1007-1009.

CERAMICS AND CONCRETE

The Processing of Enriched Uranium Oxide/Paraffin Wax Mixtures. A general description of the type of equipment used is given, and the procedure and safety precautions required for handling this type of radioactive material are outlined. ***L. D. Huckstepp and G. V. Day.*** *Powder Metallurgy*, no. 6, 1960, p. 150-159.

Hot Pressing of Ceramic Powders. The processes involved in production by the simultaneous effect of pressure and heat at temperatures above 1500 C are outlined. The factors leading to the choice of this method of fabrication, and the general principles involved in hot pressing, are dealt with, and the advantages and disadvantages of the process are discussed. Current techniques are described and their limitations considered. Examples of typical applications are given, and possible lines of future development are indicated. ***A. G. Thomas and H. J. Jones.*** *Powder Metallurgy*, no. 6, 1960, p. 160-169.

The Influence of Grinding on Kaolin and Bentonite. Wet grinding caused no appreciable disturbance in the lattice. The main effect was a splitting up of the kaolin crystal platelets into thinner platelets, thus causing the specific surface area, the cation exchange capacity, the fraction with $r < \mu m$, the sediment volume, and the thixotropy volume to increase. Dry grinding, however, did cause appreciable disturbance of the layer order in the kaolin lattice. After long grinding the platelets of kaolin and bentonite were broken up. The smaller pieces adhered together to form fine grains. Thus, the specific surface area and the cation exchange capacity increased but the fraction $r < 1\ \mu m$ and the sediment and thioxotropy volumes decreased appreciably. (*In German.*) Über den Einfluss der Mahlung auf

Kaolin und Bentonit. ***E. Köhler, U. Hofmann, E. Scharrer, and K. Frühauf.*** *Deutsche Keramischen Gesellschaft, Berichte,* v. 37, no. 11, Nov. 1960, p. 493-503.

a • *** Studies on the Young's Modulus of Silicate Glass as a Function of Temperature.** The Young's moduli of soda lime silicate glass were measured by a dynamic method. Variations of these moduli during heating, cooling and successive heating-cooling cycle were measured, and the quenching effect was observed. Variation of the internal friction was also measured in the heating course. Kinetic consideration was applied to the decrease of Young's modulus with time at constant temperature and the structural changes of network former and modifier were interpreted. ***Jiro Matsuda.*** *Review of Physical Chemistry of Japan,* v. 30, no. 1, 1960, p. 9-24.

The Strength of Glass Fibres Drawn in Vacuum. Results of a series of measurements with Pyrex glass show no significant difference between the strengths of fibers drawn and tested in vacuum and those drawn and tested in air. It is concluded that the known major defects responsible for the low strength of fibers drawn from rod are not especially sensitive to the surrounding atmosphere. ***D. G. Holloway and D. M. Schlapp.*** *British Ceramic Society, Transactions,* v. 59, Oct. 1960, p. 424-431.

The Influence of Glaza Composition on the Durability of On-Glaze Colours. An investigation on acid and alkali resistance resulted in the deduction of a general relationship between glaze composition and the resistance of on-glaze colors to acid and alkaline attack. The migration of sodium ions from glaze to color was established by means of radioisotope techniques. ***C. E. L. Franklin, J. A. Tindall, and A. Dinsdale.*** *British Ceramic Society, Transactions,* v. 59, Oct. 1960, p. 401-423.

Bubbles and Associated Structures in Fired Glazes: Hypotheses and Microscopical Observations. The biscuit is the most likely site for the continued development of bubbles. Enhanced solution of the biscuit near bubbles in the fused glaze was frequently suggested but demonstrable in only one instance; here quartz had been corroded to conform with the peripheries of adherent bubbles. Bubbles remaining at the surface of the biscuit after the glost-firing were commonly older than the newly crystallized phases formed on this surface. Similarly the residual bubbles remote from the biscuit were older than the accompanying new crystals, e.g., in matt glazes. The expansion and movement of bubbles caused the concentration and dimensional orientation of undissolved particles. Such concentration could produce spots of different opacity or color in white or in colored opaque glazes respectively. The probable advantages of making clear glazes homogeneous, especially by complete fritting, are mentioned; these include increased brightness and decreased spit-out. A fired glaze may have a homogeneous glassy layer against the biscuit but adjacent to a zone more remote from the biscuit which is rich in undissolved grains of an opacifier, or in newly formed crystals; rarely this zone in nonhomogeneous because two nonconsolute liquids have separated. The nature and origin of the glassy layer are discussed. ***W. O. Williamson.*** *British Ceramic Society, Transactions,* v. 59, Oct. 1960, p. 455-478.

*** Freezing and Thawing Tests of Lightweight Aggregate Concrete.** Results indicate the necessity for providing intentionally entrained air to attain a high level of durability, the importance of moisture content of aggregate, and the influence of strength level, i.e., water-cement ratio, on the durability. ***Paul Klieger and J. A. Hanson.*** *American Concrete Institute, Journal,* v. 32; *ACI Proceedings,* v. 57, no. 7, Jan. 1961, p. 779-796.

*** Investigation of Compressive Strength of Molded Cylinders and Drilled Cores of Concrete.** Primary purpose was to determine the relation between the 28-day compressive strength of 6 x 12-in. cylinders molded from samples of concrete mixtures from which aggregate larger than 1½ in. had been removed, and that of 6-, 8-, and 10-in. diameter cores drilled from test structures and containing aggregate graded to 3-in. or 6-in. size. ***Bryant Mather and William O. Tynes.*** *American Concrete Institute, Journal,* v. 32; *ACI Proceedings,* v. 57, no. 7, Jan. 1961, p. 767-778.

Nuclear Fuel Research. Fuel Cycle Development Program. Quarterly Progress Report, July 1 to September 30, 1960. Development of a low cost fabrication process for uranium oxide fuel. Development of uranium carbides as a nuclear fuel for lowering the cost of nuclear power. *U. S. Atomic Energy Commission, NYO-2690,* Nov. 11, 1960, 39 pp. (UF767 U3ny Contin.)

b • **Properties of Graphite. III. Crystal Compounds and Irradiated Graphite.** Most chemical reactions of graphite involve entry of atoms or molecules into the interlayer spaces between the hexagonal networks. This article describes the somewhat analogous structures which are produced when graphite is irradiated with high energy particles. ***L. C. F. Blackman.*** *Research Applied in Industry,* v. 13, Dec. 1960, p. 492-502.

c • *** Refractories in Iron and Steel Works.** Development of the consumption of French refractories per ton of steel from 1952 to 1958. Review of refractory applications in blast furnaces, in basic Bessemer, openhearth and electric steel works, and in reheating furnaces. Savings can still be made by standardizing both the quality and the size of bricks, by improving the quality of the refractories and by using refractories which are chosen exactly for the required purpose. (*In French.*) Les produits réfractaires dans la sidérurgie. ***A. Libon.*** *Revue de Métallurgie,* v. 57, Nov. 1960, p. 1033-1038.

d • *** Portland Cement + Water. Reactions in the CaO-SiO_2-H_2O System.** Discusses possible causes for the hydraulic behavior of the silicates, and the mechanism of their reaction with water. In the room-temperature region of the CaO-SiO_2-H_2O system, the hydration products consist mainly of poorly-crystallized varieties of the mineral tobermorite. Current ideas on the crystal structures and morphologies of these compounds are briefly reviewed. (*In Swedish.*) Portlandcement + Vatten. Reaktioner i systemet CaO-SiO_2-H_2O. ***L. E. Copeland and A. Grudemo.*** *Svensk Kemisk Tidskrift,* v. 72, no. 10, 1960, p. 644-651.

e • *** Facilities for Research in the Use of Refractories in Ferrous Metallurgy.** Development of research in the French refractories industry; establishment of a specialist laboratory. Activities of the Société Française de Céramique. (*In French.*) L'appui que peut apporter la recherche dans l'utilisation des produits réfractaires par la sidérurgie. ***P. Paquin.*** *Revue de Métallurgie,* v. 57, Nov. 1960, p. 1039-1041.

f • **A Short Method for the Flame Photometric Determination of Magnesium, Manganic, Sodium, and Potassium Oxides in Portland Cement.** Existing methods are modified to permit the use of one set of standard calibration solutions. ***C. L. Ford.*** *ASTM Bulletin,* no. 250, Dec. 1960, p. 25-29.

g • **An X-Ray Investigation of Systems Between Niobium Pentoxide and Certain Additional Oxides.** Binary constitutions are studied on mixtures melted to varying compositions, and in a high and low temperature condition. The primary solid solubilities in β-Nb_2O_5 are frequently extensive and accompanied by a degree of structural distortion. A number of intermediate niobates were formed for higher second-oxide contents and stability fields, transformations, lattice-dimensional and other changes are outlined. A major effect is that of the rutile and columbite-type niobates being in certain cases high and low temperature allotropic forms to one another. Several new compounds and new isomorphs to known structures were found. Homogeneity ranges, which sometimes are considerable and imply varying degrees of non-stoichiometry, are a characteristic of these phases, as well as of the primary end solid solutions. A systematic pattern of phase occurrences emerges and is discussed in the light of the periodic table and crystal chemistry. ***H. J. Goldschmidt.*** *Metallurgia,* v. 62, Dec. 1960, p. 241-250.

h • *** Strength Conditions in Reinforced Concrete Pipes.** The present Norwegian specifications for reinforced concrete pipes are difficult to meet. A reasonable explanation for the many failures of pipes has been found. Special problems including resistance to shear stresses and problems connected with safety factors are discussed. (*In Norwegian.*) Styrkeforhold ved armerte betongror. ***Arne Ytrehus.*** *Teknisk Ukeblad,* v. 107, no. 47, Dec. 22, 1960, p. 1055-1062.

High-Temperature Compatibility of Al_2O_3-, BeO-, and Metal-Coated UO_2 Particles With Graphite and Coke. As expected, the 2 to 8-μ metal coatings were badly damaged by reaction with carbon at temperatures as low as 1700 F. Both oxide coatings were completely destroyed after 6 hr at 3000 F. Considerable reaction between the matrices and Al_2O_3 and BeO coatings occurred during 1000 hr at 2500 F. Coating damage was more severe in surface particles than in particles located inside the specimens. The graphite filler and pitch binder combination used in this study was less reactive than combinations containing coke filler or resin binder. ***Arnold F. Gerds and Allison K. Smalley.*** *U. S. Atomic Energy Commission, BMI-1479,* Nov. 28, 1960, 24 pp. (UF767 U3b Contin.)

Dislocation Interaction and the High Temperature Mechanical Properties of MgO Crystals. Results are interpreted according to a dislocation interaction mechanism where a moving dislocation is impeded by an atmosphere of defects. The stress required to move a dislocation is determined by the concentration of defects present in the atmosphere, which in turn is determined by the magnitude of interaction energy between defects and the dislocation. Both the yield stress data and internal friction data yield a binding energy between the defect, presumably a positive-ion vacancy, and a dislocation of approximately 0.3 ev. ***Roger Chang.*** *U. S. Atomic Energy Commission, NAA-SR-5684,* Dec. 1, 1960, 15 pp. (UF767 Un3.1na Contin.)

Conditions of Glass Formation Among Simple Compounds. III. A critical review of the conventional approaches to glass formation. ***W. A. Weyl and E. C. Marboe.*** *Glass Industry,* v. 42, Jan. 1961, p. 23 + 4 pages.

Modern Glass Plant Instrumentation. Modern day applications of metering and control equipment for the glass tank melting process. ***R. K. Gunsaulus.*** *Glass Industry,* v. 42, Jan. 1961, p. 16 + 8 pages.

CHEMICAL ENGINEERING

New Catalysts and Polymers. Describes recent developments and research work. ***C. E. H. Bawn.*** *New Scientist,* v. 8, Dec. 1, 1960, p. 1466 + 3 pages.

Dependable Oxygen Supplies. On-site gaseous O plants are becoming the chief source of supply for much of the O required by the steel industry. ***T. A. Donegan.*** *Iron and Steel Engineer,* v. 37, Dec. 1960, p. 119-122.

New Process Produces Liquid Sulfur Directly From Sour Gas. Process using synthetic zeolite bypasses one step in the conventional method. *Oil and Gas Journal,* v. 58, no. 52, Dec. 26, 1960, p. 165.

New Corrosion-Testing Service Solves Pipe-Valve Problems. *Iron Age,* v. 186, no. 25, Dec. 22, 1960, p. 64-65.

* **Studies on Constituents of Coal Carbonization Light Oil. I. On Saturated Hydrocarbons Contained in High-Temperature Coal Carbonization Light Oil. II. On Saturated Hydrocarbons Contained in Low-Temperature Coal Carbonization Light Oil.** ***Hiroshi Yasui.*** *Chemical Society of Japan, Bulletin,* v. 33, no. 11, Nov. 1960, p. 1493-1503.

* **Glass, Enamels and Related Materials Suitable for Chemical Engineering Construction.** Some inorganic non-metallic materials of construction for chemical industry, glass, acid resistant refractories, enameled metals and the new ceramic material pyroceram are discussed with the main emphasis on their chemical durability. The discussion of the chemical and physical properties is correlated to what is known at present about the atomic arrangement in these materials. (*In Norwegian.*) Glass, emaljer og beslektede materialer egnet for kjemisktekniske konstruksjoner. ***Sigmund Urnes.*** *Teknisk Ukeblad,* v. 107, no. 44, Dec. 1, 1960, p. 983-988.

Emulsifying Machines. Types of emulsifying machinery; mixers and stirrers; vibratory mixers and homogenizers. ***E. D. Gilbert.*** *Soap, Perfumery & Cosmetics,* v. 33, Dec. 1960, p. 1289-1294.

A Jet Pump Design Theory. Consists of a one-dimensional analysis based on the momentum equation and on complete mixing, used in conjunction with an over-all pressure recovery factor which is found experimentally. ***T. W. van der Lingen.*** *ASME, Transactions, Series D, Journal of Basic Engineering,* v. 82, no. 4, Dec. 1960, p. 947-960.

Pressure Drop and Power Requirements in a Stirred Fluidized Bed. Observations disclosed that blade positioning relative to sense of rotation had a very profound effect on pressure drop as well as on power requirements. ***Max Leva.*** *A.I.Ch.E. Journal,* v. 6, no. 4, Dec. 1960, p. 688-692.

Effects of Solids on Turbulence in a Fluid. Solids do not appear to have a large effect on the diffusion rate unless there is an appreciable average slip velocity between the solids and the fluid and unless the solid concentration is high enough. ***Hisao Kada and Thomas J. Hanratty.*** *A.I.Ch.E. Journal,* v. 6, no. 4, Dec. 1960, p. 624-630.

The Effect of Plate Wetting Characteristics on Pulse Column Extraction Efficiency. ***R. H. Sobotik and D. M. Himmelblau.*** *A.I.Ch.E. Journal,* v. 6, no. 4, Dec. 1960, p. 619-624.

The Role of Porosity in Filtration. IV. Constant Pressure Filtration. New partial differential equations are presented for flow through compressible media in which q varies with cake thickness. Modifications of the conventional constant pressure equations are presented. ***F. M. Tiller and H. R. Cooper.*** *A.I.Ch.E. Journal,* v. 6, no. 4, Dec. 1960, p. 595-601.

Extractive Reaction: Batch- and Continuous-Flow Chemical-Reaction Systems, Concentrated Case. ***P. J. Trambouze and Edgar L. Piret.*** *A.I.Ch.E. Journal,* v. 6, no. 4, Dec. 1960, p. 574-578.

Filter Cake Washing Performance. Differential equations for a filter cake wash cycle are derived on the assumption that the wash liquor executes plug flow in the pores of the cake, with continuous mass transfer between the liquor and a boundary film of filtrate. ***M. T. Kuo.*** *A.I.Ch.E. Journal,* v. 6, no. 4, Dec. 1960, p. 566-568.

Sour Gas Shift Spurs New Sulfur Processes. Production of S recovered from natural gas and refinery off-gas is expanding at a rate of almost 40%/year, while world S consumption is expected to grow at an over-all rate of about 4%/year. *Chemical Week,* v. 88, no. 1, Jan. 7, 1961, p. 33-35.

Reaction-Mix Sampling Simplifies Analysis of Cat Cracker for California Standard. ***R. L. Flanders, R. J. Annesser, and D. A. Saville.*** *Oil and Gas Journal,* v. 59, no. 2, Jan. 9, 1961, p. 84-86.

Separation of Liquid Mixtures by Permeation. Best results are obtained when the charge is in the liquid phase at 50-150 C and the permeating product is removed as a vapor. ***Robert C. Binning, Robert J. Lee, Joseph F. Jennings, and Eugene C. Martin.*** *Industrial and Engineering Chemistry,* v. 53, Jan. 1961, p. 45-50.

Pyrophoric Organometallics. Understanding of the nature of hazards leads to a guide for safe use and handling procedures. ***S. B. Mirviss, A. J. Rutkowski, C. W. Seelbach, and H. T. Oakley.*** *Industrial and Engineering Chemistry,* v. 53, Jan. 1961, p. 58A + 3 pages.

* **High Density Grinding Media.** Increases efficiency of the pebble mill while utilizing existing equipment. ***R. C. Mulligan.*** *Paint and Varnish Production,* v. 51, no. 1, Jan. 1961, p. 73-75.

* **Optimal Conditions for the Manufacture of Carbon Dioxide.** An analysis is given of the functioning of the gaseous part of various dry ice plants operating on the principle of special purpose fuel combustion with monoethanolamine as absorbent. The efficiency of the plant in relation to a number of factors is elucidated. Suggestions for raising the efficiency are made. (*In Russian.*) Optimal'nyI rezhim proiznodstvu uglekislogo gaza. ***T. Pimenova.*** *Kholodil'naia Tekhnika,* v. 37, no. 6, Nov.-Dec. 1960, p. 41-45.

* **Experimental Investigation of an Air Washer.** The results of thermal and hydraulic tests of a brine air cooler with porcelain Raschig rings at high spray intensities (19-34 m^3/m^2 hr) are

given. The coefficients of sensible heat exchange and of air flow resistance are presented in the form of analytical expressions. The effect of brine viscosity on the heat exchange in the layer of Raschig rings is investigated. (*In Russian.*) Eksperimental'noe issledovanie mokrogo vozdukhookhladitelia. ***T. Sutyrina.*** *Kholodil'naia Tekhnika*, v. 37, no. 6, Nov.-Dec. 1960, p. 30-34.

Numerical Solution of the Heat Conduction Equation. ***Yudell L. Luke.*** *Chemical Engineering*, v. 68, Jan. 9, 1961, p. 95-102.

Partial Removal of H_2S From Crude Oil by Stripping With Natural Gas. ***T. R. Shipster.*** *Institute of Petroleum Review*, v. 14, Dec. 1960, p. 393-395.

* **Continuous Pressure Filter.** New Australian development extends the range of filtration machinery. *Mining & Chemical Engineering Review*, v. 53, no. 2, Nov. 15, 1960, p. 70.

* **Control of the Flow of Fluids.** Fundamental aspects of fluid flow and control, the different methods of motivation of fluids by reciprocating, centrifugal, axial flow and propeller pumps are reviewed. ***K. L. Butcher.*** *Chemical & Process Engineering*, v. 41, Dec. 1960, p. 541 + 3 pages.

How Algae Grow in Cooling-Tower Water. A two-year study of water samples from recirculating cooling towers located throughout the U. S. shows how temperature, chromate, and other chemicals affect algae growth. ***Edward Tehle, Jr.*** *Oil and Gas Journal*, v. 59, no. 3, Jan. 16, 1961, p. 84-86.

Thin-Layer Evaporation. Advantages of the thin-layer type of evaporator and its performance and applications. ***H. H. M. Jones.*** *Industrial Chemist*, v. 36, Dec. 1960, p. 599-603.

* **New Entry System for Settling Ponds.** A new system for ponds which achieves a nearly even effect with various angles of approach, water velocities and depths of water velocities, and depths of water in the pond. The most important properties of this entry are the zigzag slotted weir-wall and the prechamber. (*In German.*) Neues Einlaufsystem für Absetzbecken. ***W. Schweizer.*** *Brennstoff-Wärme-Kraft*, v. 12, Dec. 1960, p. 542-543.

* **Water Level Control in Evaporation Pans.** A float-operated ball and valve system is quite satisfactory. ***Bessel D. van't Woudt.*** *Journal of Geophysical Research*, v. 65, no. 12, Dec. 1960, p. 4031-4035.

* **The Permeability of Some Graft Copolymers of Polyethylene to Gases and Vapors.** Graft copolymers of polyethylene were prepared by gamma irradiation of polyethylene films immersed in the appropriate monomer. The majority of gas permeability measurements were made by Barrer's high vacuum technique. The data show clearly that permeation through acrylonitrile and vinylpyridine-polyethylene grafts is primarily a diffusion process, while in permeation through polyethylene-styrene grafts, there is also a crystallite solution effect. ***A. W. Myers, C. E. Rogers, V. Stannett, and M. Szwarc.*** *Journal of Applied Polymer Science*, v. 4, no. 11, Sept.-Oct. 1960, p. 159-165.

* **Sheet Ion Exchangers as Resistance Gauges for Moisture in Gases.** Practical exchanger units can be made by simply clamping two Pt electrodes on a sulphonated piece of polystyrene or better by winding a double spiral on a sulphonated rod or hole cylinder using two separated wires of Pt. ***Torbjörn Westermark.*** *Acta Chemica Scandinavica*, v. 14, no. 8, 1960, p. 1860-1862.

CHEMISTRY—ANALYTICAL

* **Nitrogen Determination in Steels, Irons and Ferroalloys.** Study of the determination of the "total" nitrogen in steels, irons and ferroalloys shows that at present no method is generally applicable to all ferrous material. In particular steels produced in certain conditions with additions or on the basis of certain raw materials may contain complex nitrogenized phases which do not reveal their nitrogen by a wet method, except under certain rather limited and inadequately defined

conditions. A silicon steel (Si $\geq$ 1%) can contain two silicon nitrides, one amorphous and the other crystalline (Si_3N_4). (*In French.*) Du dosage de l'azote dans les aciers, fontes et ferros. ***J. Calmettes and H. Guinot.*** *Revue de Métallurgie*, v. 57, Oct. 1960, p. 925-933.

* **Application of Chromatography to the Analysis of Gas Mixtures Extracted From Metals by Vacuum Melting Under Reducing Conditions.** The new techniques of gas-phase chromatography have allowed the development of a more accurate and, above all, more rapid method of analysis compared with conventional methods. Hydrogen, carbon monoxide, and nitrogen are satisfactorily separated by a column with "Linde molecular sieve". Calibration curves are plotted for each constituent. The method as a whole is examined regarding reproducibility, sensitivity, and accuracy. (*In French.*) Application de la chromatographie à l'analyse des mélanges gazeux extraits des métaux par fusion réductrice sous vide. ***C. Baqué and L. Champeix.*** *Revue de Métallurgie*, v. 57, Oct. 1960, p. 919-923.

* **Analysis of Hydrogen, Oxygen and Nitrogen in Metals by Melting Under Reducing Conditions in an Argon Atmosphere.** A brief survey of the merits of melting under reducing conditions in an Ar atmosphere and of the principle of gas-phase chromatography and a description of the method of determination and the apparatus used are given. The tests dealt mainly with the determination of oxygen and nitrogen. Good agreement was obtained between the values found by vacuum melting under reducing conditions and the new method of determination. (*In French.*) Analyse de l'hydrogène, de l'oxygène et de l'azote dans les métaux par fusion réductrice sours atmosphère d'argon. ***J. Hancart and J. Marot.*** *Revue de Métallurgie*, v. 57, Oct. 1960, p. 911-917.

The Determination of Fluorine in Cupola Slags. The determination of fluorine by distillation and gravimetric methods is time-consuming, and the methods are unsuitable for batch analyses. A spectrophotometric method was developed for the more rapid determination of fluorine in cupola slags, based on the reaction of aluminum with a ferron-aluminon reagent. The recovery of fluorine is good and results obtained by the method, which is described, are compared with those obtained for the same samples by other methods. ***H. Green.*** *B.C.I.R.A. Journal*, v. 8, no. 6, Nov. 1960, p. 838-843.

Determination of Thorium in Uranium Ores. A method was developed for the determination of one ppm of Th in one gram of U ore. Thorium was separated by lanthanum fluoride precipitation and TTA extraction. The final solution was analyzed spectrographically after adding Zr internal standard. ***R. Ko and M. R. Weiler.*** *U. S. Atomic Energy Commission, HW-66220*, Sept. 26, 1960, 17 pp. (UF767 Un3.1hw Contin.)

Coulometric Determination of Uranium in Power-Reactor-Fuel-Dissolver Solutions. The procedure consisted in three main steps; a separation of the U from the dissolver solutions diverse ions by means of tri(iso-octyl)amine, an acid stripping of the U from the organic layer, and a quantitative reduction of U(VI) by use of a controlled-potential coulometer. The solutions can be analyzed for U to within ±1%. ***B. B. Hobbs.*** *U. S. Atomic Energy Commission, ORNL-2987*, Dec. 6, 1960, 17 pp. (UF767 U3o Contin.)

Separation of Uranium From Urine by a Tri-N-octylphosphine Oxide Column and an Automation of the Procedure. The average U recovery, which includes extraction efficiency, alpha attentuation and counter variability, is 73%. ***William C. Dietrich, John D. Caylor, and Eric E. Johnson.*** *U. S. Atomic Energy Commission, Y-1322*, Sept. 15, 1960, 37 pp. (UF767 Un3.1y Contin.)

* **The Determination of Zirconium With Benzoylphenylhydroxylamine.** Zirconium is completely precipitated by benzoylphenylhydroxylamine from 0.5 *N* acid solutions. The complex formed in sulphuric acid solutions has a constant composition, $Zr(C_{13}H_{10}O_2N)_4$, and is used for the direct weighing of zirconium; the factor is 0.0970. The product precipitated from hydrochloric acid solutions must be ignited to the oxide. The reaction is sensitive, 1 p.p.m. of zirconium being detectable, and quantitative determination of 0.2 mg is possible. Thorium and the rare earths do not interfere. ***D. E. Ryan.*** *Canadian Journal of Chemistry*, v. 38, Dec. 1960, p. 2488-2492.

* **An Infrared Procedure for the Qualitative and Quantitative Identification of Rubber and Related Polymers Used in Paper Products.** This identification is achieved by the comparison of the infrared absorption spectrum of the polymer with given reference spectra. In addition, a general technique is presented for the quantitative determination of these polymers in paper. The accuracy of the quantitative method is ±2% absolute. ***C. P. Puchalsky and J. E. Newell.*** *Tappi*, v. 43, Dec. 1960, p. 197A-203A.

Substituted Benzidines and Related Compounds as Reagents in Analytical Chemistry. XVI. Anthranilic, Orthanilic, Benzidine-3,3′-dicarboxylic, and Benzidine-3,3′-disulphonic Acids as Redox Indicators. These compounds undergo reversible oxidation in acid solution and orthanilic and benzidine-3,3′-disulphonic acids are shown to be suitable redox indicators for the titration of iron(II) with cerium(IV); very sharp end points (colorless to yellow) are obtained. ***D. I. Rees and W. I. Stephen.*** *Chemical Society, Journal*, 1960, Nov., p. 4225-4228.

Estimation of Hydrogen in Pickled Steel by Vacuum Extraction at 700°C. A technique for ductility testing and hydrogen analysis of pickled specimens is described. The scatter of analysis results is high; the fluctuations are due to the samples and not the analysis; sulphide inclusions have an appreciable influence on hydrogen absorption in pickling. ***K. Sachs and M. Odgers.*** *Iron and Steel Institute, Journal*, v. 196, pt. 4, Dec. 1960, p. 406-414.

* **A Contribution to the Volumetric Determination of the Sulfate Content in Boiler Waters.** The improved method described offers the advantage of yielding very rapid reliable results even in the case of lower sulfate contents, the titration being secured by means of a current standard manganometric method. (*In German.*) Zur volumetrischen Bestimmung des Sulfatgehaltes von Kesselwässern. ***Klaus Günther.*** *GWF; Gas- und Wasserfach* (Gas), v. 101, no. 49, Dec. 2, 1960, p. 1274-1275.

* **Determination of Intracellular Magnesium by an Automatic Titration Procedure.** Experiences with the automatic titration method of quantitating serum calcium and magnesium are presented, and modifications of the original procedure to allow determination of intraerythrocyte concentrations of magnesium are described. ***Donald A. Sones, Warren F. McGuckin, and Khalil G. Wakim.*** *Clinical Chemistry*, v. 6, no. 6, Dec. 1960, p. 564-571.

Low-Level Radiochemical Separation of Manganese. Method is based on the extraction of tetraphenylarsonium permanganate into nitrobenzene. The advantages are speed, high yield, low radiochemical blank, and ability to handle several milligrams of Mn. The method has been applied to a search for a long-lived chromium-56. ***J. M. Matuszek, Jr. and T. T. Sugihara.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 35-36.

Quantitative Radiochemical Analysis by Ion Exchange Calcium, Strontium, and Barium. Similar to the method of Baerg and Bartholomew. By lowering the cross linkage of the column resin to 8% and changing the concentration and pH, analytical separation at room temperature was possible. ***Leon Wish.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 53-55.

Rapid Method for Separation and Analysis of Radioactive Fission Gases. Method involves sampling of the He stream, quantitative separation of the Xe and Kr from the He, from other fission products, and from each other, and gamma spectrometry assays for isotopes in the separated fractions. ***R. C. Koch and G. L. Grandy.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 43-48.

Radiochemical Determination of Radium in Urine. Method depends upon the cocrystallization of radium from urine with potassium rhodizonate and the purification of this extract by ion exchange. Radium is isolated in an essentially residue-free form and its recovery from urine is 94.9 ± 3.3%. ***Herbert V. Weiss and Ming G. Lai.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 39-41.

Effect of Electrode Configuration and Transition Time in Solid Electrode Chronopotentiometry. The transition time constant, $i_0 \tau^{1/2}/C^\circ$, was measured for the reduction of silver and lead, and the oxidation of iodide and hydroquinone, over a transition time range of 0.001 to 300 seconds. Rough surfaced and horizontal electrodes were also worked with. ***Allen J. Bard.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 11-15.

Radiochemical Determination of Plutonium in Urine. Plutonium was cocrystallized with potassium rhodizonate from urine. It was then purified from interfering substances by coprecipitation with lanthanum salts and by ion exchange. Finally, the radioelement was electrodeposited onto a tantalum disk and alpha counted. ***Herbert V. Weiss and William H. Shipman.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 37-39.

* **Pyridine-2-azol-1-dihydroxynaphthalene-2,3-sulphonic acid-6 and Pyridine-2-azo-4-orcine, Two New Chelatometric Indicators.** Pyridine-2-azo-2-dihydroxynaphthalene-2,3 sulphonic acid-6 can be used as an indicator for the ethylene diamine tetraacetic acid, titration of Pb^{2+}, Zn^{2+}, Cd^{2+} in slightly alkaline or neutral medium and of Cu^{2+} with pH3.3 (formate buffer). Pyridine-2-azo-4 orcine can be used as indicator for the determination of Cu^{2+} with pH2.7 (acetate chloride buffer). (*In German.*) Pyridin-2-azo-1-dihydroxynaphthalin 2,3-sulfonsäure-6 und Pyridin-2-azo-4-orcin, zwei neue chelatometrische Indicatoren. ***M. Hniličková and L. Sommer.*** *Zeitschrift für Analytische Chemie*, v. 177, no. 6, 1960, p. 425-429.

* **A Contribution to the Separation of Calcium From Magnesium.** This separation can be performed in one operation without reprecipitation, if the calcium oxalate is precipitated at room temperature from an acetic acid solution by slowly adding of ammonium oxalate solution and stirring energetically. The separation results even in the presence of high amounts of phosphoric acid are correct. (*In German.*) Zur Trennung des Calciums von Magnesium. ***I. Sarudi.*** *Zeitschrift für Analytische Chemie*, v. 177, no. 6, 1960, p. 404-407.

* **Ion Exchange Chromatography.** Discusses frontal analysis, displacement development, and elution development. Describes gradient elution apparatus and procedures. ***J. P. Redfern.*** *Laboratory Practice*, v. 9, Dec. 1960, p. 842-846.

* **Recent Developments in Gas-Liquid Chromatography.** ***A. T. James.*** *Laboratory Practice*, v. 9, Dec. 1960, p. 835-841.

* **Quantitative Determination of N-Terminal Amino Acids in Some Serum Proteins.** Results obtained from different serum protein fractions are given and compared with published data. ***Sten Eriksson and John Sjöquist.*** *Biochemica et Biophysica Acta*, v. 45, no. 2, Dec. 4, 1960, p. 290-296.

* **Separation of Peptide Derivatives by Gas Chromatography Combined With the Mass Spectrometric Determination of the Amino Acid Sequence.** The results obtained thus far reveal considerable potentialities of this method for the speedy and facile determination of the amino acid sequence of di- to pentapeptides. ***K. Biemann and W. Vetter.*** *Biochemical and Biophysical Research Communications*, v. 3, no. 6, Dec. 1960, p. 578-584.

* **A Comparison of Three Methods of Determining the Concentration of Uranium in Sea Water.** A stable isotopic dilution method and a fluorimetric method for the measurement of the concentration of U in sea water are described. In both methods the U is extracted from the sea water into chloroform using 8-hydroxyquinoline. ***J. D. Wilson, R. K. Webster, G. W. C. Milner, G. A. Barnett, and A. A. Smales.*** *Analytica Chimica Acta*, v. 23, no. 6, Dec. 1960, p. 505-514.

* **Diallyldithiocarbamidohydrazine (Dalzin) as an Analytical Reagent. Determination of Palladium and Its Separation From Nickel, Zinc and Copper.** Dalzin has been used for the determination and separation of a number of metals. Further investigation has shown that Pd can be quantitatively precipitated from hot solutions by Dalzin at pH 3.1-4.5, while most of the common ions and other Pt metals remain in solution. ***N. K. Dutt and K. P. Sen Sarma.*** *Analytica Chimica Acta*, v. 23, no. 6, Dec. 1960, p. 531-533.

* **Detection and Colorimetric Determination of Polynitro Aromatic Compounds.** In most cases a blue to green color is obtained using fluorene as the reagent. A colorimetric procedure for the analysis of *o*- and *p*-dinitro compounds is also presented. ***Eugene Sawicki and Thomas W. Stanley.*** *Analytica Chimica Acta*, v. 23, no. 6, Dec. 1960, p. 551-556.

* **Volumetric Determination of Iron and Titanium. Applications to Ilmenites.** The Fe^{3+} ions were quantitatively determined after reduction into Fe^{2+} by means of a $TiCl_3$ excess in the presence of luteotungstoarsenic acid (AsTu), an indicator with which $TiCl_3$ is reoxidized alone afterwards. Titanium as Ti^{+3} is titrated by means of Ce^{4+} or $Cr_2O_7^=$, in the presence of AsTu which acts as the indicator. The quantitative determination is valid in the presence of Fe^{2+}. (*In French.*) Dosage volumétrique du fer et du titane. Applications aux ilmeinites. ***M. Blanchet and L. Malaprade.*** *Chimie Analytique*, v. 42, Dec. 1960, p. 603-607.

Volumetric Determination of Uranium in the Presence of High Concentrations of Iron. This investigation indicated that, by using a double precipitation procedure, essentially quantitative separation of uranium tetrafluoride is possible for concentrations as low as 0.1 to 0.2 mg of uranium per 100 ml of solution, provided a suitable carrier is present and ammonium chloride is added to prevent peptization. ***Thomas J. Blalock.*** *U. S. Bureau of Mines Report of Investigations* 5687, 1960, 9 pp. (TN21 Un3r Room 290)

A Miniature Electrostatic Precipitator for Sampling Aerosols. Theory and Operation. Equations are derived describing the performance of a miniature electrostatic precipitator used for sampling aerosols, the particles of which may be considered charged exclusively by ion bombardment. Paying particular attention to the time required for the changing process, criteria are developed for judging the effectiveness with which a wet precipitator will concentrate the nongaseous constituent of an aerosol. The theory is tested experimentally. ***Myron Robinson.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 109-113.

* **Concerning 1,2,4-Triazoles. I. Reaction of Thiocarbohydrazide and Thiosemicarbazide With Aliphatic Carboxylic Acids and Their Derivatives.** Condensation of thiocarbohydrazide with aliphatic carboxylic acids or with their orthoesters yields three alkyl-4-amino-5-mercapto-1,2,4-triazoles. Nitrous acid causes deamination of these compounds to 3 alkyl-5-mercapto-1,2,4-triazoles ,which are produced also by alkaline cyclization of the 1-acyl-thiosemicarbazides accessible from thiosemicarbazide and carboxylic acid. (*In German.*) Über 1.2.4-Triazole. I. Die Reaktion von Thiocarbohydrazid und Thiosemicarbazid mit Aliphatischen Carbonsäuren und ihren Derivaten. ***Hans Beyer, Carl-Friedrich Kröger, and Gertraut Busse.*** *Annalen der Chemie (Justus Liebigs)*, v. 637, nos. 1-3, Nov. 1960, p. 135-145.

* **The Determination of Boron in Silicon by Isotope Dilution.** The sample is dissolved in aqueous sodium hydroxide in the presence of ^{10}B tracer, and the B is separated by a modification of Morrison and Rupp's method of electrolysis through a cation-exchange membrane. The B is finally determined by making isotope-dilution measurements with a mass spectrometer with a thermal-ionization source. The method has the advantage that quantitative separation of B is not necessary. Amounts down to 0.001 μg can be determined to within $\pm$ 30%. ***D. C. Newton, J. Sanders, and A. C. Tyrrell.*** *Analyst*, v. 85, Dec. 1960, p. 870-877.

* **The Polarographic Determination of Niobium in Highly Alloyed Steels.** A method is described for determining up to 3% of Nb in a wide range of ferrous alloys. The Nb is separated from the major alloying constituents as niobic acid, together with other earth-acid hydrated oxides, by hydrolysis in the presence of sulfurous acid. The oxides are ignited and fused with potassium hydroxide, the melt is extracted with dilute potassium hydroxide solution, an aliquot of the solution is adjusted to pH 1.9 in the presence of EDTA and the polarographic wave of Nb is recorded directly. In the presence of Mo, a solvent extraction precedes the final polarographic determination. ***D. J. Brindley.*** *Analyst*, v. 85, Dec. 1960, p. 877-883.

* **Colorimetric Micro-Determination of Calcium in Serum.** Calcium is precipitated directly, as its naphthalhydroxamate, by adding a slight excess of precipitant to a 0.2-ml portion of serum. After centrifugation, the excess of reagent is removed by decantation and drainage, and the unwashed precipitate is dissolved in alkaline ethylenediaminetetra-acetate solution. Addition of acid ferric nitrate develops an orange-red color, the intensity of which is a measure of the amount of calcium originally present in the serum. ***P. Trinder.*** *Analyst*, v. 85, Dec. 1960, p. 889-894.

a

* **The Spectrophotometric Determination of Boron in Molybdenum Alloys With Carmine.** The conditions controlling the development of color between boric acid and carmine red have been studied, with particular reference to the concentrations of sulfuric acid, chloride, Mo, reagent and alloying elements. A method is outlined for the direct determination of B in molybdenum alloys, over the range 0.01 to 0.20%, measurements being made spectrophotometrically at 610 mμ. The mean error over this range was found to be $\pm$ 0.006% of B. ***D. C. Higgs.*** *Analyst*, v. 85, Dec. 1960, p. 897-904.

b

* **The Effect of Substituent Groupings on the Chromatographic Behaviour of Phenoxyacetic Acids. III. The Effect of the Nature of the Substituent.** *Para*-substituted phenoxyacetic acids were chromatographed under standardized conditions. Results indicate that the greater the probability of H bonding between the substituent and the stationary phase the greater is the absorption of the acid and hence the lower is the R_F value. ***L. S. Bark and R. J. T. Graham.*** *Analyst*, v. 85, Dec. 1960, p. 907-908.

c

* **Statistical Analysis of Spectrophotometric Determinations of Boron.** One of the methods for determining B is by absorption spectrophotometry of solutions of the red compound formed by boric acid and curcumin. The course of this reaction is greatly affected by various factors, and results are sometimes erratic. Those factors causing errors can be detected by not too elaborate methods for interpreting results; other factors, however, cannot be easily interpreted as the probable cause of inconsistency between determinations. This paper describes the application of modern statistical methods to the study of the influence of certain factors on quantitative determinations of B. The application of these methods provided objective ways of establishing significant effects for the various factors involved. ***Fausto W. Lima, Constância Pagano, and Boris Schneiderman.*** *Analyst*, v. 85, Dec. 1960, p. 909-915.

d

Differential Thermal Analysis and Thermogravimetric Analysis of Fission Product Oxides and Nitrates to 1500°C. Apparatus is described for differential thermal analysis and thermogravimetric analysis. This equipment was used to study the thermal stability of strontium oxide, strontium nitrate, cesium nitrate, zirconyl nitrate dihydrate, cerous nitrate hexahydrate, ruthenium dioxide, and mixtures of these materials with alumina. ***P. F. Campbell, M. H. Ortner, and C. J. Anderson.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 58-61.

e

Detection and Estimation of Polyoxyethylene Glycol in Nonionic Surfactants by Ascending Paper Chromatography. A semiquantitative, spot-area method is described, permitting estimation of PEG to the nearest per cent. ***M. E. Ginn, C. L. Church, Jr., and J. C. Harris.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 143-145.

f

Microtechnique for the Infrared Study of Solids. Diamonds and Sapphires as Cell Materials. A microtechnique for obtaining the infrared spectra of solids and corrosive liquids, utilizing sample weights as low as 4 μg., is described. A cell in which diamonds or sapphires are used as window material is employed to obtain spectra in the 2- to 35-micron region. The visible and ultraviolet regions can also be studied. Spectra are obtained routinely, easily, and rapidly without many of the limitations inherent in other procedures. So far as is known, the method is applicable to all solids. ***E. R. Lippincott, F. E. Welsh, and C. E. Weir.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 137-143.

g

h

i

j

* **Determination of Low Molybdenum Contents in Tungsten and Tungsten Compounds.** Molybdenum was isolated from tungsten by precipitation of thioacetamide under pressure. Tungsten is obtained in a complex form in solution by means of tartaric acid. After decomposition of the sulfide precipitate, molybdenum was determined colorimetrically. Molybdenum contents up to 10^{-5}% (0.1 ppm) were so obtained. (*In German.*) Bestimmung kleiner Molybdängehalte in Wolfram und Wolframverbindungen. ***H. Buss, H. W. Kohlschütter and S. Miedtank.*** *Zeitschrift für Analytische Chemie*, v. 178, no. 1, 1960, p. 1-11.

k

Quantitative Determination of Low Atomic Number Elements Using Intensity Ratio of Coherent to Incoherent Scattering of X-Rays. Determination of Hydrogen and Carbon. The method was used to determine H and C in hydrocarbons, particularly petroleum, and in a matrix containing additional elements. Corrosions for the S and N content were developed. ***C. W. Dwiggins, Jr.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 67-70.

* **Sedimentary Rock Analysis by Charged Particle Bombardment.** Methods based on nuclear reactions in the light elements are described for the analysis of Li, Be, B, C, O, F, Na, Mg, Al, and P. The reactions are induced by proton, deuteron, and alpha particle beams from a 2-MeV Van de Graaff machine. The methods are evaluated for sensitivity and accuracy by analysis of synthetic specimens of known composition and of National Bureau of Standards analyzed rocks samples. Errors arising from stopping power variations are shown to be small, in general not more than ±2%. ***Robert F. Sippel and Everett D. Glover.*** *Nuclear Instruments and Methods*, v. 9, Oct. 1960, p. 37-48.

* **Analytical Application of Embelin. II. Estimation of Aluminium and Beryllium and Their Separation.** Embelin is employed as an analytical reagent for the estimation of Al in solutions of p_H 4.0-4.5 and Be in solutions of p_H 6.5-7.0. The reagent is also employed for the separation of Be from Al. ***Ch. Bheemasankara Rao and V. Venkateswarlu.*** *Zeitschrift für Analytische Chemie*, v. 178, no. 4, 1961, p. 277-280.

* **Back Titration With Mercuric Nitrate in Alkaline Medium. Estimation of Small Amounts of Chromium(III) and Analysis of Its Binary Mixtures With Some Other Metals.** Rapid, reliable and accurate method for the determination of trivalent chromium, based on back titrating excess EDTA solutions in the presence of chromium versenate, with mercuric nitrate in alkaline media. ***H. Khalifa and M. M. Khater.*** *Zeitschrift für Analytische Chemie*, v. 178, no. 4, 1961, p. 260-265.

Monitor for the Quantitative Determination of Beryllium in the Atmosphere. The air is drawn through a triggered intermittent arc and the intensity of the beryllium doublet at 3130 Å is monitored, together with the adjacent background, and the ratio of these intensities is recorded on a ratio recorder. Provision is made for frequent calibration by means of an aerosol of known concentration, produced by an auxiliary spark between beryllium-copper electrodes. The accuracy and sensitivity of the instrument are not materially affected by the chemical form of the Be, and are unaffected by the sizes of particles normally encountered in atmospheric dust. The instrument is mobile, fully automatic and rapid in operation, one result being produced each minute. The limit of detection is 1 $\mu g/m^3$ for a twenty-second sampling time. The instrument is considered to have potentialities for the determination of other elements in air, apart from Be. ***M. S. W. Webb, R. J. Webb, and P. C. Wildy.*** *Journal of Scientific Instruments*, v. 37, Dec. 1960, p. 466-471.

CHEMISTRY—INORGANIC AND GENERAL

The Ditertiary Arsine Complexes of Nickel, Palladium, and Platinum. The ditertiary arsine complexes of Pt^{2+} have been prepared and characterized. Their properties are compared with those of the corresponding compounds of Ni^{2+} and Pd^{2+}. Conductivity measurements and spectrophotometric studies in nitromethane show that all three metals give presumably five-coordinate cations of the type $[M^{II}(Diarsine)_2Hal]^+$. The different kinds of ditertiary arsine complexes formed by Ni, Pd, and Pt in the various oxidation states are summarized. ***C. M. Harris, R. S. Nyholm, and D. J. Phillips.*** *Chemical Society, Journal*, 1960, Nov., p. 4379-4388.

Helium Three. Proceedings of the second symposium on liquid and solid helium three, held at The Ohio State University, August 23-25, 1960. ***John G. Daunt, editor.*** 186 pp. 1960. Ohio State University Press, Columbus, Ohio. (QD181.H4 Sy68h)

Evidence for a Nitric Oxide Complex With Cupric Fluoride. Methanol is the only alcohol examined so far in which the nitric oxide-cupric fluoride cannot be formed in the presence of hydrofluoric acid: only a transient yellow coloration is obtained. The nitrosyl solutions are not stabilized by lithium or sodium fluorides as they are by hydrofluoric acid. The role of the acid is merely to depress the ionization of the covalent nitrosyl. ***R. T. M. Fraser.*** *Nature* (Suppl.), v. 188, Nov. 26, 1960, p. 738-739.

The Structure of Sodium Periodate Trihydrate and the Nature of the Periodate Ion in Aqueous Solution. ***N. Keen and M. C. R. Symons.*** *Chemical Society, Proceedings*, 1960, Nov., p. 383-384.

* **Astatine.** This study covers the history of the discovery, At in nature, the nucleogenesis of At isotopes, the volatility and adsorption of At on metals, its valence in aqueous solutions, its coprecipitation and redox reaction, its extraction, and its physical and biological properties. (*In Russian.*) Astatin. ***A. D. Meddok.*** *Uspekhi Khimii*, v. 29, no. 11, Nov. 1960, p. 1388-1406.

* **Phase Diagram of the Yttrium and Calcium Sulfide System.** The diagram was studied by the crystallographic method using tempered specimens between 600 and 1370 C. Two CaY_2S_4 phases, separated by an inversion point at 1110 C, were found, as well as a cubic homogeneity domain of the Th_3P_4 type, stable above 980 C, and a homogeneity domain formed by CaS. (*In French.*) Sur le diagramme de phases du système sulfures d'yttrium et de calcium. ***Jean Flahaut, Loris Domange, and Madeleine Patrie.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 22, Nov. 28, 1960, p. 2535-2537.

Preparation of Americium Dioxide by Thermal Decomposition of Americium Oxalate in Air. One hundred seventy-five grams of americium in a hydrochloric acid solution varying from 1 to 7 *N* was converted to americium dioxide. Americium oxalate was precipitated from 0.1 *N* HCl with 100% excess oxalic acid and was converted to the dioxide by calcination at 800 C in air. The solubility losses in the oxalate precipitation filtrate averaged approximately 7 mg per liter of solution, with a total loss of 0.09%. ***R. D. Baybarz.*** *U. S. Atomic Energy Commission, ORNL*-3003, Dec. 20, 1960, 9 pp. (UF767 U3o Contin.)

* **The Preparation and Some Properties of Germanium Difluoride.** Germanium difluoride can be prepared by the reduction of germanium tetrafluoride with Ge metal. It is a white solid, m.p. 110°, and is orthorhombic, $a = 8.30$, $b = 5.17$, $c = 4.67$ Å. It possesses strong reducing properties. ***Neil Bartlett and K. C. Yu.*** *Canadian Journal of Chemistry*, v. 39, Jan. 1961, p. 80-86.

Spectra of Tetrahedral Inorganic Complexes. It is now possible to obtain authentic simple tetrahalogeno-complexes of manganese, iron, cobalt and nickel. It proved more difficult than anticipated to obtain the spectra of these complexes because of the large solvent-complex interactions which were observed in different supposedly "inert" organic solvents. ***S. Buffagni and T. M. Dunn.*** *Nature*, v. 188, Dec. 10, 1960, p. 937-938.

CHEMISTRY—ORGANIC

Positive Halogen Compounds. II. Radical Chlorination of Substituted Hydrocarbons With *t*-Butyl Hypochlorite. Relative reactivities in competitive chlorination and isomer distributions observed with 1-chlorobutane, butyronitrile, *n*-propyl acetate and similar compounds indicate a strong polar effect in chlorinations carried out with *t*-butyl hypochlorite. ***Cheves Walling and Burton B. Jacknow.*** *American Chemical Society, Journal*, v. 82, Dec. 5, 1960, p. 6113-6115.

Stereochemistry and the Mechanism of Hydrogenation of Cycloölefins on a Platinum Catalyst. Using PtO_2 as a catalyst, the ratio of *cis*/*trans*-1/2-dimethylcyclohexanes obtained from the hydrogenation of 1,2-dimethylcyclohexene, 2,3-dimethylcyclohexene, and 2-methylmethylenecyclohexane is a function of the pressure of H_2. ***Samuel Siegel and Gerard V. Smith.*** *American Chemical Society, Journal*, v. 82, Dec. 5, 1960, p. 6082-6087.

A New Synthesis of Aziridines. A synthetic route to the hitherto unknown 2,2,3,3-tetraalkylaziridines was developed. The three-step synthesis involves the chloronitrosation of a fully substituted aliphatic or alicyclic olefin, reduction of the nitroso chloride to the chloroamine derivative, and finally cyclization of the latter with alkali to the desired compound. ***Gerhard L. Closs and Stanley J. Brois.*** *American Chemical Society, Journal,* v. 82, Dec. 5, 1960, p. 6068-6070.

a

* **Synthesis of Chrometricarbonyl Benzaldehyde and Derivatives.** By reacting the diethylacetal of benzaldehyde with chromehexacarbonyl at 160-200 C, the diacetal of the chrometricarbonyl benzaldehyde (yellow crystals m.p. 53-54 C) is obtained. Through acid hydrolysis of the latter, chrometricarbonyl benzaldehyde (red crystals m.p. 46.5-47.5 C, dec. 120-130 C) is obtained, which undergoes CANNIZZARO'S reaction. Among its derivatives the oxime, the 2,4-dinitrophenylhydrazone, and the anyl are described. (*In Italian.*) Preparazione della cromotricarbonilbenzaldeide e di suoi derivati. ***Elena Mostardini, Fausto Calderazzo, and Raffaele Ercoli.*** *Chimica e l'Industria,* v. 42, Nov. 1960, p. 1231-1234.

b

* **Oxidizing Action of Hydroperoxides. IV. On the Oxidation of Aryl Alkyl Ketones..** Acetophenone, p-methyl-acetophenone, propiophenone, t-butylphenyl ketone, benzophenone, p-nitrobenzophenone, and fluorenone were the ketones used in the study. t-Butyl- and cumylhydroperoxide were used as the oxidizing agents. The anions of the hydroperoxides are believed to be responsible for the oxidation. ***Kazuhiro Maruyama.*** *Chemical Society of Japan, Bulletin,* v. 33, no. 11, Nov. 1960, p. 1516-1520.

c

* **The Oxidation of *o*-Aminophenols by Cytochrome *c* and Cytochrome Oxidase. III. 2,3-Fluorenoquinone From 2-Amino-3-Fluorenol and Binding of Quinonoid Oxidation Products to Bovine Serum Albumin.** ***H. R. Gutmann and H. T. Nagasawa.*** *Journal of Biological Chemistry,* v. 235, no. 12, Dec. 1960, p. 3466-3471.

The Comparative Reactivity of Organosilicon and Organogermanium Halides in Fast Hydrolyses. The following characteristics of the hydrolysis reactions were observed. Hydrolysis of the silane is essentially complete, whereas that of the germane proceeds only as far as about 10% in 1:1 v/v acetone-ether. The germane is hydrolyzed more slowly than the silane. Electron-release to Ge or Si by a *p*-methyl group decreases the hydrolysis rate. The rate of hydrolysis of the germane in acetone is slower than in the less polar acetone-ether medium by a factor of 2.7 at 25°. ***J. R. Chipperfield and R. H. Prince.*** *Chemical Society, Proceedings,* 1960, Nov., p. 385-386.

d

* **Formulation and Acylation of Organic Compounds Substituted by the Amides of Carboxylic Acids.** A study covering the conditions suitable for formulation reactions and the mechanism involved, the formulation of aromatic hydrocarbons, of phenols, naphthols and their derivatives, and of aromatic amines, the production of unsaturated aldehydes and dialdehydes, the formulation of heterocyclic compounds. (*In Russian.*) Formilirovanie i atsilirovanie organicheskikh soedinenii zameshchennymi amidami karbonovykh kislot. ***V. I. Minkin and G. N. Dorofeenko.*** *Uspekhi Khimii,* v. 29, no. 11, Nov. 1960, p. 1301-1335.

e

* **Ring-Isomerization of Isoflavones. II. A New Synthesis of Tectorigenin.** 5,7,4′ Trihydroxy-8-methoxyisoflavone by means of potassium methylate is not rearranged into tectorigenin, whereas 5-hydroxy-8-methoxy-7,4′-dibenzyloxyisoflavone is rearranged into 7,4′ dibenzyl-tectorigenin. From this, tectorigenin is obtained by catalytic dibenzylation. (*In Hungarian.*) Az izoflavonok gyűrűatfordulásairól. II. A tektorigenin új szintézise. ***Loránd Farkas and József Várady.*** *Magyar Kémiai Folyóirat,* v. 66, no. 11, Nov. 1960, p. 446-447.

f

Studies in Pyrolysis. XV. Competitive Routes in the Pyrolysis of Various α-Substituted Benzyl Esters: A Novel Route to α-Diketones. Benzyl benzoate, and its derivatives containing an electrophilic α-substituent, break down pyrolytically (vapor phase, ca.500°) by two competitive primary reactions: (i) a predominating acyloxygen scission by what is essentially a retro-Tishchenko reaction, and (ii) disproportionation to benzoic anhydride and a labile ether; also there is (iii) a novel reaction yielding an α-diketone. ***E. Jones and P. D. Ritchie.*** *Chemical Society, Journal,* 1960, Nov., p. 4141-4153.

g

The Reactions of Bromine Atoms With Alkanes and Methyl Halides. The reactions of Br atoms with alkanes and with methyl halides have been studied by competitive bromination in the gas phase and analysis of the products by gas chromatography. Absolute rate constants and Arrhenius parameters are given, based on those previously found for attack on methyl bromide. The activation energies for hydrogen abstraction are probably closely related to the strengths of the C-H bonds broken. ***G. C. Fettis, J. H. Knox, and A. F. Trotman-Dickenson.*** *Chemical Society, Journal,* 1960, Nov., p. 4177-4185.

h

* **Condensation of Pyridine Aldehydes With Cyclanones.** Two aldehyde molecules react on one ketone molecule and give dipyridalcyclanone. The aldehyde β-pyridine derivatives resemble more the corresponding dibenzal cyclanones than the aldehydes α- and γ-pyridine derivatives. (*In French.*) Sur la condensation des aldéhydes pyridiques avec les cyclanones. ***P. Buu Hoï and Dat Xuong.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences.* v. 251, no. 23, Dec. 5, 1960, p. 2725-2727.

i

* **Two Real Improvements of the Aluminum Organic Synthesis.** The space-time yield of the so-called synthesis reaction of aluminum trialkyls with ethylene was increased five or six times in a continuous Cu tubular reactor by increasing the test temperature. The so-called "displacement equilibria" occur in an aluminum alkyl and olefin mixture at 300-350 C without any catalyst, within 0.2 and 2 sec. A very efficient reactor was indicated for this short time high-temperature displacement. (*In German.*) Über zwei wesentliche Verbesserungen der aluminiumorganischen Synthese. ***Kurt Zosel.*** *Brennstoff-Chemie,* v. 41, no. 11, Nov. 1960, p. 321-325.

j

* **Naphthaquinones. II. Derivatives of Naphthalene-2,7-Diol.** The oxidation of 1,6-dibromo-2,7-dimethoxynaphthalene has been reinvestigated and the 1-bromodimethoxy-compound has yielded a new bromonaphthaquinone. A transbromination of 1,6-dibromonaphthalene-2,7-diol has been noticed, while an azo-dye from this dibromodiol is shown to have a structure different from that expected from the earlier literature. ***R. D. Wilson.*** *Tetrahedron,* v. 11, no. 4, Nov. 1960, p. 256-265.

k

* **Cyclopropanes From 1°-Alkyl Chlorides by α-Elimination.** The reaction of appropriate primary alkyl chlorides with Na or K gives cyclopropanes, in addition to previously observed hydrocarbons. Through the use of tritium and deuterium, it was proved that isobutyl chloride produces methylcyclopropane by a mechanism involving α-elimination to a carbene and insertion into a carbon-hydrogen bond. Isobutylene is formed by α- and β-elimination. No α-elimination (as reflected by cyclopropane production) is found with s-butyl chloride, methyl isobutyl ether or with methyl isobutyl sulfide. ***W. Kirmse and W. von E. Doering.*** *Tetrahedron,* v. 11, no. 4, Nov. 1960, p. 266-271.

* **Ketones Derived From Phyllocladene.** Phyllocadene has been converted into some 15- and 16-oxo derivatives. ***R. Henderson and R. Hodges.*** *Tetrahedron,* v. 11, no. 4, Nov. 1960, p. 226-230.

* **D-Homosteroids. Boat Conformation of the D-Ring.** Chemical evidence is cited in support of the boat conformation of ring-D in certain D-homosteroids. The interconversion of ketolic isomers ostensibly by methyl migration is presented. ***N. L. Wendler.*** *Tetrahedron,* v. 11, no. 4, Nov. 1960, p. 213-218.

* **The Structure of 2,4-Dibromomenthone.** A three-dimensonal X-ray diffraction study has shown that the product obtained by bromination of D- or L-menthone is 2,4-dibromomenthone. The two Br atoms and the isopropyl and methyl groups are *trans.* ***J. A. Wunderlich and W. N. Lipscomb.*** *Tetrahedron,* v. 11, no. 4, Nov. 1960, p. 219-225.

* **New Preparation of Acetoxyesters by Means of Lead Tetraacetate Acting on the Monosubstituted Ethyl Acid Malonates.** The new method based on the oxidation of malonic acid esters by means of lead tetraacetate permits the passage in three stages from RX halides to acetoxyesters. (*In French.*) Nouvelle préparation d' α-acétoxyesters par action du tétracétate de plomb sur les malonates acides d'éthyle monosubstitués. ***Michel Vilkas and Massoud-Rouhi-Laridjani.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 251, no. 22, Nov. 28, 1960, p. 2544-2545.

*** Investigations on Pesticidal Phosphorus Compounds. III. The Structure of the Reaction Product of 3-Amino-5phenyl-1,2,4-triazole and Bis(dimethylamido)phosphoryl Chloride (WP 155).** ***B. G. Van Den Bos.*** *Recueil des Travaux Chimiques des Pays-Bas,* v. 79, Nov. 1960, p. 1129-1136.

*** The Chemistry of the N-Alkylaldimines. II. The Reaction of N-Propylpropanaldimine With Acid Chlorides.** N-Propylpropanaldimine adds on acid chloride with formation of the corresponding N(1-chloropropyl)-N-propylamides, which on heating split off hydrochloric acid to yield the N(1-propenyl)-N-propyl derivatives as the final products. N(1-propenyl)-N-propylacetamide, N(1-propenyl)-N-propylbenzamide, diethylamino-(1-propenylpropylamino)-dichlorosilane and dichlorophosphor-N(1-propenyl)-N-propylamidic acid have been prepared by this method. ***H. Breederveld.*** *Recueil des Travaux Chimiques des Pays-Bas,* v. 79, Nov. 1960, p. 1197-1202.

*** Synthesis of Alkyl-Substituted 3-Phenyl-4-Hydroxycoumarins.** A number of 3-phenyl-4-hydroxycoumarins with alkyl-substituents in the 3-phenyl group were synthesized. ***B. Van Zanten and W. Th. Nauta.*** *Recueil des Travaux Chimiques des Pays-Bas,* v. 79, Nov. 1960, p. 1211-1222.

*** Chemistry of Acetylenic Ethers. XLVI. Addition of Thiols to Acetylenic Ethers. XLVII. Preparation of α-Ketols From Ethoxyethynylcarbinols. XLVIII. Vinyloxyethyne and Vinyloxy-1-hexyne.** The free-radical addition of ethanethiol to ethoxyethyne produces much *cis* and a little trans 1-ethoxy-2-(ethylthio)ethene, whereas the nucleophilic addition of sodium ethanethiolate yields 1-ethoxy-1-(ethylthio)ethene. The same applies to additions of other thiols. XLVI. ***H. J. Alkema and J. F. Arens.*** XLVII. ***J. H. Sperna Weiland and J. F. Arens.*** XLVIII. ***L. Brandsma and J. F. Arens.*** *Recueil des Travaux Chimiques des Pays-Bas,* v. 79, Nov. 1960, p. 1257-1281; 1293-1300; 1307-1310.

*** Study of the Reactions Between Titanium Tetrachloride and Ethylaluminium Compounds in Hydrocarbon Solution. II. Gaseous Reaction Products.** Gaseous reaction products from the systems $AlEt_3/TiCl_4$, $AlEt_2Cl/TiCl_4$ and $AlEtCl_2/TiCl_4$ in isooctane solution at 80 C have been studied. A set of reactions explaining the formation of the observed products H_2, C_2H_6, C_2H_5Cl, n-C_4H_{10} and n-C_6H_{14} is given. It is possible to account nearly quantitatively for the conversion of the ethyl groups and for the extent of reduction of $TiCl_4$. It appeared that the formation of ethane is partly due to disproportionation of ethyl groups, and partly to ethyl groups abstracting hydrogen from the isooctane. In the system $AlMe_3/TiCl_4$ the methyl groups quantitatively react in the latter way to form CH_4. The isooctane to a small extent decomposes into isobutane and isobutene or into isopentane and propene. It is supposed that the brown precipitates formed in the reduction of $TiCl_4$ act as catalysts for this decomposition. ***E. J. Arlman and J. R. De Jong.*** *Recueil des Travaux Chimiques des Pays-Bas,* v. 79, Nov. 1960, p. 1319-1328.

*** A Procedure for Determining the Molar Extinction Coefficients of Metal Dithizonates.** Methods for evaluating the molecular extinction coefficients of metal complexes with dithizone are reviewed and a method of general applicability is proposed. The procedure is illustrated by the determination of the molecular extinction coefficients of Ag and Hg dithizonates. ***H. Irving and R. S. Ramakrishna.*** *Analyst,* v. 85, Dec. 1960, p. 860-867.

Detection of *p*-Cresol in Spot Test Analysis. A test for *p*-cersol is based on the formation of a blue color lake if the *p*-cresol is coupled with diazotized *p*-nitroaniline, and the product is then brought into contact with magnesium oxide in alkaline surroundings. This test will reveal 0.2 μg. of *p*-cresol. The isomeric *o*- and *m*-cresols and phenol do not show this reaction. ***Fritz Feigl and Vinzenz Anger.*** *Analytical Chemistry,* v. 33, Jan. 1961, p. 89-90.

*** The Steric Relationships Between Homoterpenyl Methyl Ketone, Terpenylic Acid and Terebic Acid.** Terpenylic acid has been resolved into its optical antipodes. The acid contains a lactone ring and the corresponding hydroxy dicarboxylic acid has no asymmetric carbon atom. ***Rune Sandberg.*** *Arkiv för Kemi,* v. 16, no. 3, 1960, p. 255-265.

*** Studies on Peroxy Compounds. IV. The Introduction of the Benzoyloxy Group Into Benzyl Ethers According to the Kharasch-Sosnovsky Method.** By copper salt catalyzed decomposition of *t*-butyl perbenzoate in the presence of benzyl methyl ether, benzyl ethyl ether, benzyl *iso*-propyl ether, benzyl *t*-butyl ether and benzyl phenyl ether, the benzoyloxy group has been introduced. No fragmentation or dimerization of the intermediate benzyl radical was observed. In the case of dibenzyl ether, the benzaldehyde dibenzyl acetal was isolated. ***Sven-Olov Lawesson and Curt Berglund.*** *Arkiv för Kemi,* v. 16, no. 3, 1960, p. 287-294.

*** Dialdehyde Starch, Properties, Fabrication and Commercial Perspectives.** The chemical structure, hydrolysis to erythosis and glyoxal, oxidation to starch to dialdehyde starch with periodic acid, development of a fabrication process by means of electrolysis and the continuous method now applied and future possibilities were studied. (*In German.*) Dialdehydstärke Eigenschaften, Darstellung und technische Perspektiven. ***G. Tegge.*** *Stärke,* v. 12, Nov. 1960, p. 321-327.

*** A Synthesis of 1-Hydroxy-8-Methoxyanthraquinone-3-Carboxylic Acid.** The structure, previously obtained by the action of dimethyl sulfate on the Na salt of synthesized rhein monoglucoside, has now been confirmed by synthesis. ***A. C. Bellaart and C. Koningsberger.*** *Recueil des Travaux Chimiques des Pays-Bas,* v. 79, Nov. 1960, p. 1289-1292.

*** A New Method of Synthesis of Dialkylphosphinous Esters.** Method gives interesting results for the production of the above esters having radicals on the P atom which are C_3 or larger. The diethylphosphinous ester yield increases with the increase of the number of C atoms in the radical of the ester group. The hydrolysis of acid chloride of dibutylphosphinous acid gave the corresponding acid. (*In Russian.*) Novyĭ metod sinteza efirov dialkilfosfinistykh kislot. ***M. I. Kabachnik and E. N. Tsvetkov.*** *Akademiia Nauk SSSR, Doklady,* v. 135, no. 2, Nov. 1960, p. 323-326.

*** On Steroid Nucleotides. II. Synthesis of Δ5-3β-Hydroxy-Steroid Nucleotides.** 5-Androsten-3β-ol-17-one-ADP, 5-pregnen-3β-ol-20-one-ADP, and 5-pregnene-3β, 17α-diol-20-one-ADP have been prepared from Δ5-3β-hydroxy-steroid-phosphoric acid and the dicyclohexylguanidinium salt of AMP-phosphoramidate. The synthesis of 5-androsten-3β-ol-17-one-ATP was achieved by condensation of 5-androsten-3β-ol-17-one-phosphoric acid and ADP, using dicyclohexyl-carbodiimide as condensing agent. After purification by column chromatography, paper chromatography in two solvent systems and paper electrophoresis, the Δ5-3β-hydroxy-steroid nucleotides were found to be relatively unstable. ***Georg W. Oertel and Balwant D. Agashe.*** *Biochimica et Biophysica Acta,* v. 45, no. 1, Dec. 4, 1960, p. 1-8.

*** A New Method for the Production of 2-Arylidenindandiones-1,3.** The new method eliminates the necessity to prepare indandione-1,3. Satisfactory yields of arylidenindandiones-1-3 give aromatic aldehydes containing nitro-, dialkylamino-, metoxy- and other groups in the molecule. Such products of condensation as 2 oxy-3-metoxybenzal- and 2-oxynaphthalindandiones-1,3 go through further transformations. Indenopyranols are obtained by the condensation of O-oxyaldehydes with indandione-1,3 in the presence of HCl. (*In Russian.*) Novyĭ metod poluchenііa 2-arilindenindandionov-1,3. ***A. K. Aren, B. E. Aren, and G. Ia. Vanag.*** *Akademiia Nauk SSSR, Doklady,* v. 135, no. 2, Nov. 1960, p. 320-322.

A New Synthesis of Tetra-Alkylhypo-Phosphates. Tetra-alkylhypophosphates can be readily obtained by the action of sulphuryl chloride on sodium dialkylphosphites. Physical constants and yields of the tetralkylhypophosphates obtained are listed. ***J. Michalski and T. Modro.*** *Chemistry & Industry,* 1960, no. 51, Dec. 17, p. 1570.

*** A New Method to Obtain Isopropylidene-L-Ascorbic Acid.** This acid was obtained from a suspension of salts of Ba, of L-ascorbic acid and other organic acids. The R_f value was given for the acid studied in the system of the following solvents: n-butanol, glacial acetic acid, water (40:10:50). The R_f is 0.84. (*In Serbian.*) Nova metoda dobijanja izopropilidenaskorbinske kiseline. ***Aleksandar F. Dmanski and Milan O. Mirić.*** *Khemisko Drushtva Beograd, Glasnik,* v. 23-24, nos. 5-6, 1959, p. 271-273.

* **Reactions of Bisamides. XIV. Condensations of N, N'-Benzylidenebisacetamide With Ketones and Diketones.** N, N'-benzylidenebisacetamide condenses with cyclopentanone in such a way that both active methylene groups, adjacent to the carbonyl group, react and dibenzylidene-cyclopentanone is formed. By condensing 1,3-cyclohexanedione with the same compound amide rests are eliminated and 2-benzylidene-1,3-cyclohexanedione is formed. (*In Serbian.*) O reaktsionim sposobnostima bisamida. XIV. Reaktsije N,N'-benzilidenbisatsetaida s ketonima i diketonima. ***Gjorgje Stefanović and Vera Vandjel.*** *Khemisko Drushtva Beograd, Glasnik,* v. 23-24, nos. 5-6, 1959, p. 253-259.

Technique of Organic Chemistry. v. I. Pt. IV. Physical Methods of Organic Chemistry. ***Arnold Weissberger, editor.*** 3rd Ed. 904 pp. 1960. Interscience Publishers, Inc., New York. (QD453 W44p3)

Organic Syntheses. An annual publication of satisfactory methods for the preparation of organic chemicals. ***Melvin S. Newman, editor.*** v. XL. 114 pp. 1960. John Wiley & Sons, New York. (QD262 Or3s Vis.)

CHEMISTRY—PHYSICAL

Dissociation Energies of Diatomic Molecules. Force constant, dissociation energy, and equilibrium internuclear distance in a sequence of similar diatomic molecules have been found to be related by the expression $k_e r_e (D_e = \text{const})$. Applicability has been shown for eighteen sequences of similar molecules. ***G. R. Somayajulu.*** *Journal of Chemical Physics,* v. 33, Nov. 1960, p. 1541-1553.

A Proposal for Calculation of Thermodynamic Properties of He^3. Formal expressions are given for the average number of particles and the average energy of a system of interacting particles. Simpler expressions for these quantities, which are more amenable to calculation, are obtained as approximations. A self-consistent procedure for calculating these quantities at a given temperature and chemical potential is discussed. ***R. E. Mills and R. L. Mills.*** Paper from "Helium Three", p. 78-80, 1960. Ohio State University Press, Columbus, Ohio. (QD181.H4 Sy68h)

* **The Dissociation Energies of the H_2, HD, and D_2 Molecules.** The far ultraviolet absorption edges of H_2, HD, and D_2 were studied under high resolution and the different limits corresponding to absorption from different lower state rotational levels were observed. The sharpness of the limits for low, as compared to those for high J values, shows that the upper electronic state has no potential maximum which might have falsified the values of the dissociation limit. ***G. Herzberg and A. Monfils.*** *Journal of Molecular Spectroscopy,* v. 5, no. 6, Dec. 1960, p. 482-498.

* **Determination of Size of Small Particles by Light Scattering. Experiments on Ludox Colloidal Silica.** Four samples of Ludox colloidal silica were studied by the light transmission and angular scattering method and the size of particles determined. The apparent particle sizes in aqueous solutions of Ludox were smaller than those in 0.05 M NaCl solutions, the latter being in very good agreement with electron microscopic values. The refractive index increments of Ludox in water and 0.05 M NaCl were determined at three wavelengths. The influence of cell length and blackening of the cells in transmission measurements were also studied. All results indicated that particles of Ludox behave practically as *Rayleigh* scatterers. The usefulness of these results for the calibration of light scattering photometers is discussed. ***Gj. Deželić and J. P. Kratohvil.*** *Kolloid-Zeitschrift,* v. 173, no. 1, Nov. 1960, p. 38-48.

* **The Effect of Temperature on the Magnetic Susceptibility of Vanadium Pentoxide Systems.** Magnetic susceptibilities of certain systems supported by kieselgur have been determined in the temperature interval 30 to 400 C. The plot of reciprocal susceptibility against temperature for all the systems studied indicates sudden deflections about 150° lower than optimum catalytic activity. These points may mark the temperatures of commencement of structural changes which may be responsible for the activity of these catalysts. ***V. Ramakrishna.*** *Kolloid-Zeitschrift,* v. 173, no. 1, Nov. 1960, p. 35-38.

* **Diffusion of Liquids in Unsaturated Paper.** ***Arthur L. Ruoff, George H. Stewart, Hyung Kyu Shin, and J. Calvin Giddings.*** *Kolloid-Zeitschrift,* v. 173, no. 1, Nov. 1960, p. 14-20.

Lattice Heat Capacity of the Rare Earths. Heat Capacities of Yttrium and Lutetium From 15-350°K. The heat capacities are found to have the same dependence on a reduced temperature as does that of La. The lattice heat capacities are given by Θ values of 130.7, 166.0, and 213.7 for La, Lu, and Y and the corresponding electronic heat capacities are given by γ values of 100, 95, and 85 x 10^{-4} joules/g atom-deg^2. ***L. D. Jennings, R. E. Miller, and F. H. Spedding.*** *Journal of Chemical Physics,* v. 33, Dec. 1960, p. 1849-1852.

Critical Solution Phenomenon in Two-Component Liquid Systems. The System Water-Ethylene Glycol Mono-Isobutyl Ether. ***De F. P. Rudd and B. Widom.*** *Journal of Chemical Physics,* v. 33, Dec. 1960, p. 1816-1819.

Vapor Pressures and Related Thermodynamic Properties of the Isotopic Nitric Oxide Molecules. These properties are interpreted in terms of the known structure of interacting dimers. It is shown that structural considerations alone suffice to calculate the relative O^{18} to N^{15} isotope effects on vapor pressure, heats of vaporization, and triple points. ***Jacob Bigeleisen.*** *Journal of Chemical Physics,* v. 33, Dec. 1960, p. 1775-1777.

First-Order Phase Transitions of Six Normal Paraffins at Elevated Pressures. By a modification of standard piezometric techniques, phase transition pressures, as well as the associated isothermal isobaric volume changes were determined at approximately 25 C intervals. Correlations established between the melting temperatures and the specific volume changes associated with phase transitions and the *n*-paraffin chain lengths show a strong dependence upon whether the *n*-paraffin is of odd or even species. ***R. R. Nelson, W. Webb, and J. A. Dixon.*** *Journal of Chemical Physics,* v. 33, Dec. 1960, p. 1756-1764.

Methyl Affinities Determined by Photolysis of Azomethane. Reactions previously investigated in an acetyl peroxide system were reinvestigated using the photolysis of azomethane as the source of radicals. The results prove that at least in hydrocarbon solvents methyl radicals, and not acetate radicals, are the reacting species in the acetyl peroxide system. Furthermore, it was shown that photolysis of azomethane in solution provides a clean and simple system to study reactions of methyl radicals. ***C. Steel and M. Szwarc.*** *Journal of Chemical Physics,* v. 33, Dec. 1960, p. 1677-1680.

Generation of Free Carriers in Photoconducting Anthracene. I. Determinations are from an investigation of the spatial distribution of trapped electrons. A tentative extrinsic model for the generation of free carriers is proposed in which electrons are injected at the negative electrode, free holes and trapped electrons are generated by the incident radiation in the bulk at impurities or other defects, and free holes are generated by the incident radiation at the positive illuminated electrode. The conclusion is that anthracene is an extrinsic rather than an intrinsic photoconductor. ***W. Moore and M. Silver.*** *Journal of Chemical Physics,* v. 33, Dec. 1960, p. 1671-1676.

* **Further Studies on Redoxokinetic Titrations.** "Redoxokinetic effect" is used to indicate end-points of titrations of Fe^{2+} with $Cr_2O_7^{2-}$, sulphuric acid with sodium hydroxide, AsO_2^- with I_2 and Ag^+ with Cl^-. ***S. Visvanathan, K. Sundararajan, and U. H. Narayanan.*** *Electrochimica Acta,* v. 2, no. 4, May 1960, p. 235-239.

* **On the Nature of the Free Surface Potential of Aqueous Solutions.** The isomers of hydroxybenzoic acid provide an instructive example of increase of the potential drop at the free surface of water. When the molecule contains two dipole groups, one of which is hydrophilic and the other negative, comparatively well separated, as in the *p*-isomer, then the substance increases the potential. *O*-hydroxybenzoic acid, however, decreases the potential, and the *m*-isomer increases the potential less than does the *p*-isomer. ***B. Kamieński.*** *Electrochimica Acta,* v. 3, no. 3, Oct. 1960, p. 208-210.

* **Thermal Quantities of Cycloparaffins. IV. Heats of Combustion of Cycloparaffins With 10-17 C Atoms.** A brief description is given of the preparation and purification of the samples. The enthalpies $-\Delta H_R$ are given in a table which refers to the reactions: C_nH_{2n}(s or l) + 1.5 n O_2(g) → n CO_2(g) + n H_2O(l) at 25° and 1 atm. ***J. Coops, H. Van Kamp, W. A. Lambregts, B. J. Visser, and H. Dekker.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 79, Nov. 1960, p. 1226-1234.

* **Ultraviolet Absorption Spectra of Some Sterically Hindered *p,p'*-Dimethoxystilbenes.** ***W. H. Laarhoven, R. J. F. Nivard, and E. Havinga.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 79, Nov. 1960, p. 1153-1164.

* **Spectrophotometric Investigations of the Mechanism of Complex Formation. III. Complexes of Aluminium Chloride With Bis-(Cyclopentadienyl)-titanium Dichlorides.** Spectrophotometric titration curves of aluminum chloride with bis-(cyclopentadienyl)-titanium dichloride reveal the formation of two complexes: $(C_5H_5)_2TiCl\cdot(AlCl_3)_2$ and $(C_5H_5)_2TiCl\cdot(AlCl_3)_3$. The spectra of these complexes are shown. ***E. H. Adema, H. Bos, and C. H. Vrinssen.*** *Recueil des Travaux Chimiques des Pays-Bas*, v. 79, Nov. 1960, p. 1282-1288.

* **The Coefficient of Autodiffusion of Lead Tetramethyl.** A C-14 labeled substance was used in measuring the coefficient of autodiffusion between 15 and 30 C. Density, viscosity, and index of refraction were measured within the same range of temperature. The results were compared with corresponding values of tin tetramethyl. The molecules of these substances have equal volumes; whereas the masses differ by a factor of 1.5. (*In German.*) Der Selbstdiffusionskoeffizient von Bleitramethyl. ***W. Bambynek.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 25, nos. 5-6, Sept. 1960, p. 403-414.

* **Thermal Conductivity of Ammonium Halides in the Region of Their II/III Phases.** A measuring arrangement with a plate-like test specimen is described. With this specimen polycrystalline NaCl, NH_4Cl, NH_4Br, and NH_4J were measured. Characteristic stages in the temperature curve of the thermal conductivity were found. They coincide with the individual phase temperatures. The height of the stage decreases considerably in the Cl, Br, I series so as to be no longer recognized in I. This behavior is discussed. (*In German.*) Über die Wärmeleitfähigkeit der Ammoniumhalogenide im Bereich ihrer II/III-Umwandhlungen. ***Kuno Apel and Clara von Simson.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 25, nos. 5-6, Sept. 1960, p. 393-402.

* **Catalysis by Means of Phthalocyanine. I. Kinetics and Mechanism of the Autoxidation of Cumol in the Presence of Phthalocyanines. II. Catalysis of the Autoxidation of Benzene Hydrocarbons by Means of Copper-Phthalocyanine. III. Decompositon of Cumylhydroperoxide in the Presence of the Phthalocyanine of Cobalt and Copper.** (*In German.*) Katalyse durch Phthalocyanine. I. Kinetik und Mechanismus der Autoxydation von Cumol in Gegenwart von Phthalocyaninem. II. Katalyse der Autoxydation von Benzolkohlenwasserstoffen durch Kupfer-Phthalocyanin. III. Zersetzung von Cumylhydroperoxyd in Gegenwart der Phthalocyanine von Kobalt und Kupfer. ***Heinz Kropf.*** *Annalen der Chemie (Justus Liebigs)*, v. 637, nos. 1-3, Nov. 1960, p. 73-118.

Thermistor Micromethod for Molecular Weight. A highly sensitive thermistor method for molecular weight determination has been used with water, benzene, 1,4-dioxane, carbon tetrachloride, ethyl acetate, and chloroform as solvents. The apparatus is essentially a twin thermistor bridge, by means of which may be detected a temperature difference as low as 1.5 x 10^{-4} C arising from the difference in solvent activity between drops hanging on the thermistors at 30 C. A useful technique measures the unkown solution against a series of standards and thereby avoids a separate calibration. ***Abraham Wilson, Louis Bini, and Robert Hofstader.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 135-137.

The Critical Temperatures and Pressures of Binary Systems: Hydrocarbons of All Types and Hydrogen. A method for their prediction has been developed primarily on the basis of data for binary hydrocarbon systems available in the literature. The validity of this method has been checked not only on the binary systems used to obtain these correlations but also on binary and ternary systems which have not been included in this development. Critical values for 18 systems, consisting primarily of two components, have been calculated for 96 compositions and have been compared with the experimental values presented in the literature. ***Robert B. Grieves and George Thodos.*** *A.I.Ch.E. Journal*, v. 6, no. 4, Dec. 1960, p. 561-566.

Mass Transfer With Interfacial Absorption Methyl Chloride Into Water. Studies of this surface-active gas by a laminar water jet show that for contact times of 1 m sec. or greater the absorption rate is the same as would be predicted for a system with no abnormal interfacial properties. ***S. H. Chiang and H. L. Toor.*** *A.I.Ch.E. Journal*, v. 6, no. 4, Dec. 1960, p. 539-542.

Kinetics of Mixed-Bed Deionization. I. Mixed-bed deionization of 0.0002 to 0.01N sodium chloride solutions at flow rates in the range of 3 to 70 gal/(min) (sq ft) with bed depths of 0.25 to 3.2 ft was investigated. The rate of ion exchange was found to be limited by a liquid-film mass transfer mechanism in the high purity water range (< 1 μ micromho/cm effluent conductivity). Temperature effect in the range 15 to 45 C is given. Methods for prediction of effect of both changes in particle size distribution and incomplete regeneration of the component ion exchange resins are presented. A tentative correlation is given which estimates the effect of solute and solvent species. ***Norman W. Frisch and Robert Kunin.*** *A.I.Ch.E. Journal*, v. 6, no. 4, Dec. 1960, p. 640-647.

Thenoyltrifluoroacetone: Polarographic and Spectrophotometric Behavior, and Dissociation Equilibria. Mechanisms of Electrolytic Reduction. Over the usual pH range, (TTA) gives four polarographic waves, whose presence and properties depend upon the pH, the specific buffer used, and the buffer component concentration. Spectrophotometric examination of TTA solutions, before and after controlled potential electrolysis at a massive mercury cathode, has made possible an explanation of the complex polarographic behavior on the basis of the various tautomeric and acid-base equilibria involving TTA species, including assignment of the polarographic waves to the various TTA species present. The observed variations in the polarographic behavior of TTA in different alkaline buffers are probably due to specific catalytic effects of buffer components upon the specific rate constants for the conversion of ionized, nonreducible (at the potentials involved) TTA species to unionized, reducible species. ***Philip J. Elving and Philomena G. Grodzka.*** *Analytical Chemistry*, v. 33, Jan. 1961, p. 2-11.

* **Proton Magnetic Resonance of Thiophenes. IV. Preparation of Deuterated Thiophenes.** Concerns work on the relation between substituent effects and chemical shifts in the NMR-spectra of mono-substituted thiophenes. It was found that certain derivatives such as methyl, methylthio and halogen substituted thiophenes did not give completely resolved spectra at 40 Mc/s. To obtain accurate shifts for these compounds and check theoretical interpretations of these complex spectra, deuterated compounds have been studied. In the present paper the preparation of these compounds is given. ***Salo Gronowitz, Pinchas Moses, and Rolf Håkansson.*** *Arkiv för Kemi*, v. 16, no. 3, 1960, p. 267-285.

* **Isomerizations of Azoxy Compound. Investigation With the Aid of O^{18}.** Explains how hydroxylation in the ortho or para regrouping of azoxy compounds was due to the O of the azoxy group of the O medium, and also the effects on the process caused by substitutes (NO_2, Br, and others). In determining the structure appearing in the para-regrouping of a symmetric intermediate compound, the mechanism of isomerization to one form of azoxy compound into the other (β into α) was also studied. (*In Russian.*) Izuchenie izomerizatsii azoksisoedinenii s pomoshch'iu O^{18}. ***M. M. Shemiakin, Ts. E. Agadzhanian, V. I. Maĭmind, R. V. Kudriavtsev, and D. N. Kursanov.*** *Akademiia Nauk SSSR, Doklady*, v. 135, no. 2, Nov. 1960, p. 346-349.

* **Effect of Plastic Deformation on Ionic Conductivity of Silver Chloride.** Plastic deformation of AgCl crystal at room temperature produced a conductivity increase that varied with strain. The conductivity increase recovered slowly at temperatures of the extrinsic range. At higher temperatures the recovery of the conductivity increase corresponded to the disappearance of the birefringent bands. ***Kiyoshi Shimizu.*** *Review of Physical Chemistry of Japan*, v. 30, no. 1, 1960, p. 1-8.

Interferometric Spectra of Ammonia and Carbon Monoxide in the Far Infrared. Spectra of NH_3, NH_2D, and CO have been obtained interferometrically, using the large lamellar grating interferometer at The Johns Hopkins University. The CO spectrum is used to illustrate the technique, and to show that some information may be obtained directly from the interferograms, without recourse to a numerical Fourier transformation. The spectrum of NH_3 shows pure rotation and inversion transitions in v_2 vibrational fundamental. ***Ernest V. Loewenstein.*** *Optical Society of America, Journal*, v. 50, Dec. 1960, p. 1163-1165.

Vibration-Rotation Bands of N_2O. The spectrum of nitrous oxide has been measured with a high-resolution grating spectrometer in the region from 2395 to 3510 cm^{-1}. Long absorbing paths were used in a heated cell, so that it was possible to observe many of the weaker bands, including those with lower vibrational levels, v_2 $2v_2^0$, $2v_2^2$, and v_1. Accurate values of the rotational constants were obtained, including the l-type doubling and variations with v and l of the centrifugal stretching constant. ***Eugene D. Tidwell and Earle K. Plyler.*** *Optical Society of America, Journal*, v. 50, Dec. 1960, p. 1243-1263.

Infrared Spectra of Water Sorbed on Synthetic Zeolites. The infrared spectra of water sorbed on several synthetic zeolites is discussed in terms of the molecular species present. Three different sets of bands are observed for water as the water content on the zeolite is varied. Evidence for surface OH groups for synthetic zeolites is presented. A technique for reducing the scattered light of zeolite powders by wetting them is suggested. It is possible to study surface OH groups by this technique using D_2O as the wetting agent. ***Herman A. Szymanski, Dennis N. Stamires, and Gregory R. Lynch.*** *Optical Society of America, Journal*, v. 50, Dec. 1960, p. 1323-1328.

The Photolysis of Acetone. The effects of pressure, intensity, and surface/volume ratio on $R_{CH_4}/R^{\frac{1}{2}}_{C_2H_6} = \gamma$ have been investigated between 217 and 327°. The plot of γ vs. p, the concentration of acetone, are linear but with positive intercepts, the magnitude of which increases with intensity and temperature. ***B. DeB Darwent, M. J. Allard, M. F. Hartman, and L. J. Lange.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1847-1850.

The Radiation Chemistry of Aqueous Permanganate Solutions. The reduction induced by Co^{60} γ-rays has been investigated in acid, neutral, and alkaline solution. ***Malcolm Daniels.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1839-1847.

Adsorption From Binary Solutions of Non-Electrolytes. A treatment of binary regular solutions is presented using the Grand Partition Function and the Bragg-Williams approximation. Explicit solutions of the problem are found when the surface makes a small perturbation of the solution composition; at the critical point for phase separation; and when adsorption is confined to the first or surface layer of the solution. ***G. Delmas and D. Patterson.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1827-1830.

Bonding in Conjugated Halogen Compounds. The effect of inclusion of dπ orbitals in halogen conjugation is considered. The factors determining the conditions for dπ-pπ hybridization are analyzed, and V.B. structures are proposed. In particular, $Y^+ = R = X^-$, where Y is a strong electron donating group, seems to be important. ***J. R. Hoyland and Lionel Goodman.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1816-1821.

Sigma Values From Reactivities. The schematics for classification and treatment of reactivities of *m*- and *p*-substituted derivatives of benzene in terms of σp correlations are presented. The limitations on precise Hammett linear free energy relationships which are imposed by reaction type and solvent conditions are emphasized and recently proposed modifications of the relationship are shown to be intelligible in terms of electronic distribution effects. ***Robert W. Taft, Jr.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1805-1815.

A Molecular Orbital Model for Infrared Band Intensities: Functional Group Intensities in Aromatic Compounds. The model is for compounds of the form XC_6H_4S where S contains the absorbing functional group and X is a *meta* or *para* substituent. For a given group S the intensity is related to the π electronic energy levels in the substituted benzene, C_6H_5X. ***Theodore L. Brown.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1798-1804.

The Analysis of Molecular Wave Functions by Nuclear Magnetic Resonance Spectroscopy. A valence-bond formulation is presented for the relationship between molecular wave functions and the electron-coupled nuclear spin interactions observed. For nonbonded atoms, the coupling depends on the deviations from perfect pairing in the wave function. For directly bonded atoms, the coupling constant depends on parameters, such as orbital hybridization and bond polarization, in localized electron-pair functions. ***Martin Karplus.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1793-1798.

Gas Phase Oxidation of the Xylenes. General Kinetics. The kinetics of the slow combustion of the three xylene isomers were studied manometrically in a quartz vessel, under static conditions at subatmospheric pressures over the temperature range from 410 to 550°, employing 1:1 to 1:20 hydrocarbon:oxygen mixtures. ***Franklin J. Wright.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1944-1950.

The Mutual Diffusion of Light and Heavy Water. With the aid of a new diffusion cell and Rayleigh interferometry the mutual diffusion was measured, at 5, 25, and 45° over the entire range of composition. ***L. G. Longsworth.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1914-1917.

The Diffusion Coefficients of Pb^{210} and Cl^{36} in Molten $PbCl_2$-KCl Mixtures in the Vicinity of the Composition $2PbCl_2 \cdot KCl$. The measurements were made for three compositions of $PbCl_2$-KCl mixtures: 25.2, 33.3, and 37.0 mole % KCl, over a temperature range of about 100° from within about 10° of the melting point. ***Gerald Perkins, Jr., R. B. Escue, James F. Lamb, Troy H. Tidwell, and J. Wayne Wimberley.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1911-1914.

Activity Coefficients of Silicotungstic Acid; Ultracentrifugation and Light Scattering. Coefficients were measured by equilibrium ultracentrifugation. The results agree with the Debye-Hückel theory for a 1-4 electrolyte, with a distance of closest approach parameter of 7.6 Å. ***James S. Johnson, Kurt A. Kraus, and George Scatchard.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1867-1873.

The Principle of Minimum Entropy Production and the Kinetic Approach to Irreversible Thermodynamics. A distinction is made between a steady state in detail, in which certain reactive intermediates come to a steady state, and a steady state in the large, in which substances in larger concentrations come to a steady state under certain restraints. It is shown very generally that in either case a state is reached in which the rate of entropy production is a minimum consistent with the constraints imposed, provided the system is not far removed from equilibrium. ***O. K. Rice.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1857-1860.

Conditions for a Steady State in Chemical Kinetics. A general set of inequalities involving kinetic quantities, and necessary for steady-state stability, is derived. Also necessary is that all the roots of a certain determinantal equation be negative. These criteria are applied to a number of examples. ***O. K. Rice.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1851-1857.

A Kinetic Study of the Coupling of Hexachlorocyclopentadiene to Form Bis-(Pentachlorocyclopentadienyl). By a suitable choice of solvent medium it has been possible to study the kinetics of the homogeneous bimolecular reductive coupling. ***Carleton W. Roberts, Daniel H. Haigh, and W. G. Lloyd.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1887-1891.

The Stability and Screw Sense of the α-Helix in Poly-β-benzyl-L-aspartate. Investigations showed that the α-helical form of poly-β-benzyl-L-aspartate is considerably less stable relative to the solvated randomly coiled form than that of poly-γ-benzyl-L-glutamate. The left-handed α-helix of poly-β-benzyl-L-aspartate is more stable than the right-handed one. The difference in stability between the two senses of α-helix is much less in the case of poly-β-benzyl-L-aspartate than in that

of poly-γ-benzyl-L-glutamate or poly-L-alanine. ***E. M. Bradbury, A. R. Downie, A. Elliott, and W. E. Hanby.*** *Royal Society, Proceedings*, v. 259, ser. A, Nov. 22, 1960, p. 110-128.

* **The Chemical Action of Ultrasonics.** Several examples were mentioned, as was the influence upon sonochemical processes of the following factors: intensity and frequency of ultrasonic waves, a kind of dissolved gas, the constitution, concentration and temperature of the solution being irradiated. The mechanism of the chemical action of ultrasonics was discussed. Some examples of possibilities of application were given. (*In Czech.*) Chemiczne Działanie ultradźwięków. ***Maria Górska.*** *Wiadomosci Chemiczne*, v. 14, Dec. 1960, p. 759-778.

* **A Contribution to the Determination of the Combustion Heat of Solid Fuels.** A method is described, involving no manipulation and a very simple calculation, for the acid extraction necessary for the above determination from the total S content of the solid fuel in question. (*In German.*) Beitrag zur Bestimmung der Verbrennungswärme fester Brennstoffe. ***Erich Friehmelt and Fritz Steinbrecher.*** *Brennstoff-Chemie*, v. 41, no. 11, Nov. 1960, p. 333-334.

* **The Thermodynamics of Contact Surfaces.** A system with a boundary layer is described. This layer is considered as a phase with a certain substance content. On this basis the characteristic function of the phase depending on the interface or interfacial tension is determined. After introducing the specific values, the specific excess values which do not contain the volume phase portion are defined. For each definition the conditions of possible introduction of the various values are closely considered. (*In German.*) Zur Thermodynamik der Grenzflächen. ***G. Sandstede.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 25, nos. 5-6, Sept. 1960, p. 360-374.

* **The Effect of Monochromatic Light on the Concentration of Large Ions.** There is a slight increase in the ion concentration in the presence of monochromatic light within the range 4,030-5,670 Å (i.e. from violet to green). ***A. F. Elnadi and N. Farag.*** *Tellus*, v. 12, no. 3, Aug. 1960, p. 327-331.

* **On the Type Characteristic of the Electron Configuration of Atoms.** By grouping the quantum levels according to the sum of the main and orbital quantum numbers, it is possible to determine a value in identical correspondence with the type of electron configuration of neutral nonexcited atoms in the element-analogues on the whole extent of the periodic system, and that on the basis of the law of successive filling of the $(n + l)$ groups, a rational expression can be given for the periodic dependency of this value on Z. (*In Russian.*) K kharakteristike tipa elektronnoĭ konfiguratsii atomov. ***V. M. Klechkovskiĭ.*** *Akademiia Nauk SSSR, Doklady*, v. 135, no. 3, Nov. 1960, p. 655-658.

* **Effects of Ultrasonics on Catalytic Ability of Gels and MnO_2 Suspensions.** The effects of gels and MnO_2 suspensions irradiated with intensive ultrasonics on the decomposition of H_2O_2 were studied. The growth curves of precipitated O as a function of time in the irradiated systems in comparison with nonirradiated systems have a maximum during part of the irradiation time and resemble absorption curves. (*In Russian.*) Vliianie ul'trazvuka na kataliticheskie sposobnosti geleĭ i suspenzīĭ MnO_2. ***A. Gregush and P. Gregush.*** *Akusticheskiĭ Zhurnal*, v. 6, no. 4, 1960, p. 441-445.

* **Helix-Coil Transformation and Titration Curve of Poly-L-Glutamic Acid.** The report shows that the experimental result, the titration curve and its modified plot, can be divided into three sections, that is, the ionization of the perfect helix, the region of the helix-coil transformation, and the ionization of the perfect coil. ***Akiyoshi Wada.*** *Molecular Physics*, v. 3, no. 5, Sept. 1960, p. 409-416.

* **Influence of the Hydrogen Bond on the Probability of Internal Conversion to the Triplet Level in the Quinoline Molecule.** A solution of quinoline in a pure hydrocarbon solvent at 77 K shows only phosphorescence. Addition to the solution of small amounts of alcohol (~1%) leads to the appearance of fluorescence. These facts are ascribed to the influence of the H bond that is formed between the N atom of the quinoline and the H of the OH group of the alcohol on the probability of internal conversion of the quinoline molecule from the fluorescent to the phosphorescent state. A quantitative evaluation of the probability of internal conversion in quinoline has been carried out. ***V. L. Ermolaev and I. P. Kotlyar.*** *Optics and Spectroscopy* (Cover-to-cover translation of *Optika i Spektroskopiia*), v. 9, no. 3, Sept. 1960, p. 183-186.

Dipole Moment Data and Hyperconjugation. ***Ricardo Carvalho Ferreira.*** *Nature*, v. 188, Dec. 3, 1960, p. 848.

Reversible Behaviour of the Ultra-Violet Irradiated Deoxyribonucleic Acid and Its Apurinic Acid. ***Shih Yi Wang.*** *Nature*, v. 188, Dec. 3, 1960, p. 844-846.

* **A Refinement of the Structure of 5-10 Dioxiphenazine.** The structure of 5-10 dioxiphenazine was refined by a V. Eller "photosommateur" and by the Olivetti - Bull Gamma ET machine. The thermal motion of the atoms of the phenazinic skeleton is approximately determined by the rigid-body vibrations and librations of the molecule. The accurate determination of the length of the *N-O* bond gives the value of 1.266 Å. (*In Italian.*) Raffinazione della struttura della 5-10 diossifenazina. ***Vincenzo Riganti, Renato Curti, and Alessandro Coda.*** *Ricerca Scientifica*, v. 30, Oct. 1960, p. 1570-1576.

* **Production and Properties of ^{32}P-Labelled Penta-, Hexa-, Hepta- and Octaphosphates.** From a mixture of radioactively labeled polyphosphate, molecularly homogeneous polyphosphates were separated by anion exchanger chromatography. The phosphates were derived by monophosphate decomposition from the chain end as well as from the penta to octaphosphate increasingly, with trimetaphosphate formation. The stability in aqueous solution decreased with increase of the chain length. (*In German.*) Darstellung und Eigenschaften von ^{32}P-markierten Penta-, Hexa-, Hepta- und Oktaphosphaten. ***Wolfgang Wieker.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 64, nos. 8-9, Nov. 1960, p. 1047-1050.

* **Comparative Investigation of the Solvent Extraction of Protactinium, Tantalum, Niobium and Zirconium From Concentrated Hydrochloric Acid.** The following extraction agents were used: undiluted tri-n-butylphosphate, 0.01 m tri-n-octyl-phosphine oxide in benzene and undiluted di-iso-butyl carbinol. In addition to hydrochloric acid, mixtures with concentrated complex-forming substances such as hydrofluoric acid, oxalic acid and tartaric acid, and in some cases perchloric acid, were used as aqueous phases. (*In German.*) Vergleichende Untersuchung der Lösungsmittelextraktion von Protactinium, Tantal, Niob und Zirkon aus starker Salzsäure. ***Hans-Ludwig Scherff and Günter Herrmann.*** *Zeitschrift für Elektrochemie; Berichte der Bunsengesellschaft für Physikalische Chemie*, v. 64, nos. 8-9, Nov. 1960, p. 1022-1033.

* **Using the Central Multiple X-Ray Diffusion to Determine the Specific Surface of Heterogeneous Substances.** The pattern of the curve of the intensities transmitted by a specimen depends only on its mass and specific surface. Results obtained by this technique with carbon black and alumina specimens are compared with other methods such as electron microscopy, Porod method, etc. The fields of application and characteristics of these methods were determined. (*In French.*) L'emploi de la diffusion centrale multiple des rayons x pour la determination de la surface spécifique de substances hétérogénes. ***R. Baro.*** *Journal de Chemie Physique*, v. 57, Nov.-Dec. 1960, p. 1029-1038.

* **The Kinetics of Reaction of Potassium Persulfate With Amines in Aqueous Solutions.** At 20 C, in slightly alkaline solutions with $[P_0] = [A]_0 = 0.025$ mol/l, monoethanol amine is not oxidized by persulfate; diethanol amine reacts at a measured rate ($k°_{20} = 0.085$ mol^{-1}l^{+1}·min^{-1}); under the same conditions triethanol amine reacts much more rapidly with persulfate. The kinetics of persulfate with triethanol amine at 20 C closely depends on the initial concentrations of the amine as well as of the persulfate. (*In Russian.*) Kinetika reaktsii persul'fata kaliia s aminami v vodnykh rastvorakh. ***O. A. Chaltykian and N. M. Beilerian.*** *Akademiia Nauk Armianskoĭ SSR, Doklady*, v. 31, no. 2, 1960, p. 73-77.

* **Transfer of Material Between Two Liquid Phases. I. Passage Rate of a Constituent Through the Interface of Two Phases. II. Diffusion Rate of the Transfer From a Constituent Between Two Semi-Infinite Phases. III. Effects of the Surface-Active Agents on the Transfer Rate.** (*In French.*) Transfert de matière entre deux phases fluides.

I. Vitesse de passage d'un constituant à travers l'interface de deux phases. II. Vitesse diffusionnelle de transfert d'un constituant entre deux phases semiinfinies. III. Influence des agents tensio-actifs sur la vitesse de transfert. ***A. Vignes.*** *Journal de Chimie Physique*, v. 57, Nov.-Dec. 1960, p. 980-1005.

* **Some Chemical Applications of Nuclear Magnetic Resonance.** Discussion is based on quantum aspects. ***Max T. Rogers.*** *Record of Chemical Progress*, v. 21, no. 4, Dec. 1960, p. 197-210.

Kinetics of the Thermal Decomposition of Propylene, and of Propylene-Inhibited Hydrocarbon Decompositions. The main products studied between 580 and 640 C, were found to be ethylene, methane, and H, in the approximate ratio 2:2:1. Smaller amounts of ethane, propane, butenes, benzene, toluene, and diallyl were found, but no allene was detected. ***K. J. Laidler and B. W. Wojciechowski.*** *Royal Society, Proceedings*, v. 259, ser. A, Dec. 6, 1960, p. 257-266.

* **Conductometric Determination of a Few Physico-Chemical Constants of Murexide.** Measurements were made at 30 + 0.05 C using a Serfass conductivity bridge. The following physico-chemical constants were calculated; thermodynamic dissociation constant, ionic mobility of purpurate ion, ionic radius, diffusion coefficient. ***N. A. Ramaiah and R. K. Chaturvedi.*** *Indian Academy of Sciences, Proceedings*, v. 52, sec. A, no. 5, Nov. 1960, p. 197-208.

* **Cryometry in Ice-Potassium Nitrate Eutectic. Note I.** Reports cryometric measurements of chlorides, bromides, nitrates and sulphates of metals belonging to the first and second group of the periodic system in the ice-potassium nitrate eutectic. They describe a convenient apparatus for cryometric measurements in the neighborhood of 0 C. In the discussion of the results, the possibility is shown of computing the ionization constants for some of the sulfates investigated. (*In Italian.*) Criometrie in eutettico ghiaccio-nitrato potassico. Nota I. ***Cesare Sinistri, Paolo Franzosini, and Giuseppe Ajroldi.*** *Ricerca Scientifica*, v. 30, Oct. 1960, p. 1584-1599.

Theoretical Basis for Kinetic Effects in Gas-Solid Chromatography. Lateral diffusion in the gas phase as well as sorption-desorption kinetics may both influence the plate height of gas-solid chromatography. A mathematical model is presented here which allows for the fundamental diffusion and reaction processes of gas-solid chromatography. The theory is written in a general form which can be readily extended to more complex phenomena. ***J. Calvin Giddings.*** *Nature*, v. 188, Dec. 3, 1960, p. 847-848.

Infra-Red Spectra of Chemisorbed Molecules. I. Acetylene and Ethylene on Silica-Supported Metals. Infrared spectra have been obtained in the C-H bond-stretching region for acetylene chemisorbed on the metals Pd and Cu, and for ethylene chemisorbed on Pd; poorer quality spectra were obtained for both gases adsorbed on Ni. The finely divided metal samples were supported on high-area porous silica glass. The surface species derived from the initial chemisorption of acetylene on Pd and Cu were found to be olefinic in type; those from ethylene on Pd were predominantly olefinic but some CH bonds of saturated groupings could also be detected. ***L. H. Little, N. Sheppard, and D. J. C. Yates.*** *Royal Society, Proceedings*, v. 259, ser. A, Dec. 6, 1960, p. 242-256.

COATINGS

* **Dicyclohexane Epoxides in Varnishes.** Preparation and polymerization of the adduct. ***K. L. Hoy.*** *Paint Industry Magazine*, v. 75, Dec. 1960, p. 8 + 2 pages.

* **What's All the Fuss About Fire-Retarding Coatings?** Intumescent coatings; the urea types; gas forming properties; isocyanates; ammonium bicarbonate. ***Fred D. Johnson.*** *Paint Industry Magazine*, v. 75, Dec. 1960, p. 12 + 2 pages.

* **Hazards in the Use of Isopolyesters as Maintenance Coatings.** ***R. W. Stephenson and L. B. Fosdick.*** *American Industrial Hygiene Association Journal*, v. 21, no. 6, Dec. 1960, p. 522-525.

Solvents for Decorative and Industrial Alkyd-Based Coatings. ***L. M. Barakan.*** *Paint Technology*, v. 24, Nov. 1960, p. 22 + 3 pages.

Zinc Sulphide Pigments in Synthetic Resin Dispersions for Exterior Paints. ***A. Lenz.*** *Paint Technology*, v. 24, Nov. 1960, p. 18-21.

* **Some Observations on Flotation and Flooding in Paints.** The flotation and flooding behavior of TiO_2 with synthetic yellow oxide, lamp black, phthalocyanine blue and Prussian blue in five alkyds of differing acid and hydroxyl values are studied. ***A. B. Lock.*** *Oil & Colour Chemists' Association, Journal*, v. 43, Dec. 1960, p. 859-870.

* **Spectral Reflectivities of White Paints.** A small but significant absorption in the violet end of the visible spectrum is shown to be associated with poor pigment dispersion and with high porosity. ***V. R. Ivanuski and E. H. Tompkins.*** *Oil & Colour Chemists' Association, Journal*, v. 43, Dec. 1960, p. 833-841.

* **How Cathodic Protection Affects Shipbottom Coatings.** ***W. J. Francis, Herman S. Preiser, and Frank E. Cook.*** *Corrosion*, v. 16, Dec. 1960, p. 12 + 1 page.

* **Painting of Welds.** Residues caused by the electrode coating should be removed from the weld area, preferably by blast cleaning, before painting. When this is not possible, several types of pretreatments, such as washing with dilute chromic or phosphoric acid followed by a rinse, were helpful. ***John D. Keane and Joseph Bigos.*** *Corrosion*, v. 16, Dec. 1960, p. 93-99.

* **Minimum Paint Film Thickness for Economical Protection of Hot Rolled Steel Against Corrosion.** ***Wouter Bosch.*** *Official Digest*, v. 32, Dec. 1960, p. 1602-1610.

Thermal Aspects of the Growth of Thin Films by Vacuum Sublimation. The temperature of an overgrowing film will be essentially that of the substrate when growth is by a continuous film mechanism. High film temperatures thus necessitate low-substrate thermal capacities in order that the heat of sublimation released on formation of the film may elevate the temperature of the system appreciably. The possibility of high-transient temperatures being attained in the initial stages of growth by a three-dimensional aggregation process exists when deposition is at a very high rate onto a substrate of low thermal diffusivity, and migration of the incident material is rapid. ***G. Gafner.*** *Philosophical Magazine*, v. 5, ser. 8, Oct. 1960, p. 1041-1048.

* **Maintenance Painting of Fresh Water Steel Structures.** ***Fletcher W. Shanks.*** *Official Digest*, v. 32, Dec. 1960, p. 1627-1635.

* **Maintenance Painting of Structural Steel.** Covers methods used to survey plant corrosion problems to determine where maintenance painting is necessary. ***S. C. Frye.*** *Official Digest*, v. 32, Dec. 1960, p. 1642 + 3 pages.

Fluidized-Bed Coating. A Growing Outlet for Plastics. ***P. W. Sherwood.*** *Plastics (London)*, v. 25, Dec. 1960, p. 495-496.

Some Commercial Aspects of Water-Thinned Paints. Two types of water-soluble resins are described in some detail and finishes made from them are compared with conventional solvent-based paints on a cost basis. ***A. Tremain.*** *Paint Manufacture*, v. 30, Dec. 1960, p. 433-436.

Recent Advances in the Use of Epoxide Resins in Surface Coatings. High solids coatings which give thick films in one application have been developed. Typical formulations are given. ***R. J. Turner and J. O. Ranger.*** *Paint Manufacture*, v. 30, Dec. 1960, p. 421-425.

The Setting of Road Tar in Surface Dressing. A method is described for determining the contributions of oxidation and loss of oils to the observed hardening. Results for one pair of dressings are given. ***J. R. Dewhurst.*** *Journal of Applied Chemistry*, v. 10, pt. 2, Nov. 1960, p. 470-476.

* **Development of Steel Cladding With Plastics.** After examining the approximate melting temperature, the temperature limit of use, and preheating temperature as well as other

physical properties of different plastics such as thick or thin polyestyrene, PVC, nylon and polypropylene, the different methods such as punching dispersion, fluidization, pipe coating with PVC, wrapping tape application in connection with the revestment of wires, pipes, and other articles were studied. (*In Czech.*) Vývoj plátování oceli plastickými hmotami. ***František Wiesner and Marcela Zezulova.*** *Hutnické Listy*, v. 15, no. 12, Dec. 1960, p. 971-978.

* **Paint Finishing in Russian Industry.** A review of "Technology of Non-Metallic Coatings" by A. Ya. Drinberg, E. S. Gurevich, and A. V. Tikhomirov, 547 pages, which is translated to English. ***A. A. B. Harvey.*** *Electroplating and Metal Finishing*, v. 13, Dec. 1960, p. 460-463.

* **Printing Inks for Corrugated Board.** Covers a few of the many aspects of printing inks for the corrugated industry. ***Robert W. Reid.*** *Tappi*, v. 43, Dec. 1960, p. 216A-218A.

* **The New Tung Oil Industry.** The Pan American Tung Research and Development League paves the way for expanded coatings research utilizing tung oil. ***Tom Epperson and R. O. Austin.*** *Paint and Varnish Production*, v. 51, no. 1, Jan. 1961, p. 55-67.

Flame Spraying of Alumina. Presents the basic principles involved in the process of coating metals with alumina. *National Bureau of Standards, Technical News Bulletin*, v. 44, Dec. 1960, p. 202-203.

* **Coating of Paper.** Points out that the advantage of the blade coater compared with the roll coater is a smoother coating layer on the paper in a shorter time and with drier coating paste. A drawback is a certain unreliability in the coating process. (*In Finnish.*) *Paperin päälystämisestä.* ***Kari Hornamo.*** *Paperi ja Puu*, v. 42, no. 11, 1960, p. 565 + 11 pages.

* **Glycerolysis Reaction of Linseed Oil.** Kinetic aspects of the reaction are detailed, and a simple analytical formula is shown to hold which is useful to express the composition changes during the course of the reaction. Correlation between methanol solubility and the composition is discussed. ***Kyoichi Shibayama.*** *Mitsubishi Denki Laboratory Reports*, v. 1, no. 4, Oct. 1960, p. 97-109.

How to Make Azo Pigments. Lithol-rubine process yields product as powder or dispersion, typifies chemistry, technology behind azo pigments. ***N. P. Chopey.*** *Chemical Engineering*, v. 68, Jan. 9, 1961, p. 74-77.

* **Vitreous Enamel in Building Design.** An account of British developments with enameled aluminum. *Industrial Finishing (London)*, v. 12, Dec. 1960, p. 40-44.

* **Chemical Conversion Coatings.** A survey of processes suitable for Al, with an account of their characteristics and applications. ***F. C. Porter.*** *Industrial Finishing (London)*, v. 12, Dec. 1960, p. 23 + 5 pages.

* **How to Encapsulate With Alkyds.** Molding practices used with electrical components. ***J. J. Moylan and J. T. Long.*** *Applied Plastics*, v. 3, Dec. 1960, p. 38-41.

* **P.T.F.E. Aqueous Dispersions.** Dispersions are made especially for applying to metals and other surfaces which will withstand a processing temperature of around 400 C. *Applied Plastics*, v. 3, Dec. 1960, p. 34-35.

* **Cement-Coated Epoxy A New Self-Bonding Magnet Wire.** The availability of cement-coated epoxy magnet wire has eliminated the barrier that existed in the use of self-bonding wires at elevated temperatures. ***E. H. Olson and R. P. Arndt.*** *Insulation*, v. 7, Jan. 1961, p. 29-31.

* **Diallyl Phthalate Resin Varnishes for Dip Encapsulation.** Resin cures, application and processing, reinforcing agents and fillers, catalysts and cure time are discussed. ***James Thomas.*** *Insulation*, v. 7, Jan. 1961, p. 25-27.

Painters' Problems. II. Report on a panel discussion of problems commonly encountered in paint application. *Products Finishing*, v. 25, no. 4, Jan. 1961, p. 62 + 6 pages.

Diepoxides for Surface Coatings. The acid reactivity of the cyclohexene oxide derivatives can be used to prepare interesting coatings systems from the diepoxide EP-201 and drying oil fatty acids. ***K. L. Hoy.*** *American Paint Journal*, v. 45, Jan. 16, 1961, p. 66 + 6 pages.

* **The Synthesis of the Main Triglycerides of Linseed Oil.** Monoacid triglycerides, trilinolin and trilinolenin were obtained by reaction of acid chloride on the corresponding glyceride in a chloroform medium in the presence of a base (quinoline, pyridine). The production of symmetric diacid and triacid triglycerides is more complicated and is described in detail. (*In Russian.*) Sintez osnovnykh triglitseridov l'nianogo masha. ***I. K. Sarycheva, et al.*** *Akademiia Nauk SSSR, Doklady*, v. 135, no. 3, Nov. 1960, p. 617-619.

* **The Gelation Point of Alkyd Resins.** Using Flory's basic method, an equation is derived for the gelation point of oil-modified alkyd resins in which account is taken of the different reactivities of the various carboxyl groups. The resultant modified equation is useful when phthalic anhydride is used as the dibasic acid because of the widely differing carboxyl group reactivities which occur in this case. ***M. Jonason.*** *Journal of Applied Polymer Science*, v. 4, no. 11, Sept.-Oct. 1960, p. 129-140.

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

* **Practical Methods of Analogue-to-Digital Conversion.** In the form of a digital voltmeter it is useful in production departments where accurate measurements have to be made by unskilled operators. In the laboratory it is useful where greater accuracy is required than can be obtained by other methods or where a transient is to be measured. Digitisers of the Miller run-down type are general purpose instruments of fairly high accuracy working at relatively high level. ***R. I. Ostler.*** *Instrument Practice*, v. 14, Dec. 1960, p. 1305-1312.

Orientation of Solar Instruments in Space. The eye system consists of two pairs of coarse eyes and a pair of fine eyes that provide electrical signals proportional to the error angle. The coarse eyes have a wide angle of view and provide signals to acquire the target initially. The fine eyes have high static gain to satisfy the final pointing requirement. ***Charles H. Reynolds, Merle Reisbeck, and R. E. Hathaway.*** *Electronics*, v. 33, no. 52, Dec. 23, 1960, p. 43-47.

* **New Methods of Control-System Investigation.** A well-known Soviet control engineer discusses the connection between invariance theory and methods of investigating the "reliability" of measuring devices. ***A. G. Ivakhnenko.*** *Control*, v. 3, no. 30, Dec. 1960, p. 96-99.

Magnetic-Latching Crossbar Switches. New magnetic-latching hold magnets make it possible for the economical, time-tested crossbar switch to be used in switching systems where low power is a factor. With a single, low-power pulse, the many magnets involved in a switching path can be locked up, magnetically, for the duration of a telephone call. ***F. A. Zupa.*** *Bell Laboratories Record*, v. 38, Dec. 1960, p. 457-462.

* **On Programming the Numerical Solution of Polynomial Equations.** Numerical techniques are presented for computing the roots of polynomial equations. By applying the recommended scaling and inversion rules, the basic Birstow and Newton-Raphson iterative techniques can be applied with great reliability. ***Kenneth W. Ellenberger.*** *ACM Communications*, v. 3, Dec. 1960, p. 644-647.

* **Programmed Error Correction in Project Mercury.** One of the obvious ways of alleviating error difficulties is to operate two or more identical devices in parallel. This method has been employed in many critical areas of the Mercury system, notably in the parallel operation of two IBM 7090's. ***B. Dimsdale and G. M. Weinberg.*** *ACM Communications*, v. 3, Dec. 1960, p. 649-652.

* **Nonlinear Servomechanism of Limited Dynamic Range.** The nonlinear portion of a servomechanism of limited dynamic range may be arranged such that the remaining linear function

is the transfer ratio of the actual linear system. The simplified form of equation 18 may be employed for the case of a saturating power amplifier and d-c motor having static and coulomb friction with $a \geq 10$ and $T_r \leq 0.1\ T_s$. ***R. L. Moruzzi and F. B. Tuteur.*** *Applications and Industry*, 1960, no. 51, Nov., p. 314-320.

A New, Solid-State, Nonlinear Analog Component. Describes a passive, nonlinear device which, when used with operational amplifiers, provides the means for obtaining a large class of functions to a degree of accuracy and reliability not previously possible with a simple, economical device. A basic varistor squaring unit is described. ***L. D. Kovach and W. Comley.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 4, Dec. 1960, p. 496-503. (TK1 In6.6e Vis.)

System Application of Hybrid Logic Circuitry. The "Hybrid Transistor Diode Logic" (HTDL) circuit technique employs either diodes or emitter follower transistors as gates and buffers, to maximize the circuit performance rating. The HTDL technique optimizes the use of the transistor through nonsaturating, low-impedance circuitry. ***J. T. Lynch and J. J. Karew.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 4, Dec. 1960, p. 418-423. (TK1 In6.6e Vis.)

The Simplification of Multiple-Output Switching Networks Composed of Unilateral Devices. Two-level networks composed of unilateral switching devices such as diodes can be simplified or minimized in much the same manner as single-output networks. This is accomplished by extending the notation and techniques used in the simplification of two-level single-output switching networks to multiple-output switching networks. ***G. C. Vandling.*** *IRE Transactions on Electronic Computers*, v. EC-9, no. 4, Dec. 1960, p. 477-486. (TK1 In6.6e Vis.)

* **Systematic Measurements of k_v-Values of Control Valves.** A determination of k_v by comparison seems to be most economical and accurate. Plotting the results in a graph-paper with functionally divided scales according to $1/x^3$ permits separation of valve-body resistance and flow coefficient a as well as realization of predetermined flow-characteristics. The conversion-factors for the different coefficients, which depend on the units of measurement, are stated. (*In German.*) Systematische Messungen von k_v-Werten an Regelventilen. ***F. W. Warnecke.*** *Règelungstechnik*, v. 8, no. 11, Nov. 1960, p. 405-409.

* **Producing Transistor Assemblies.** Transistor assembly system includes six dial indexing units, two ovens, and a multistation welding machine. System produces transistor assemblies, each of which includes a collector dot, Ge disc, emitter dot, base washer, collector wire, emitter wire, and prefabricated header. *Automation*, v. 8, Jan. 1961, p. 60-65.

* **Control by Static Magnetic Switching.** Discusses fundamentals of static magnetic switching devices, present logic diagrams, and circuits using standardized magnetic amplifier modules. ***Bernard J. O'Neill and Lee Weissman.*** *Automation*, v. 8, Jan. 1961, p. 73-80.

* **Automatic Screwdown Control in Rolling Mills With Punched-Card Programming.** A major step towards automatic control of rolling mills is the automatic adjustment of the positions of the rolls—or screwdown as it is called. The principle and design of the system of positional control in conjunction with programming are explained. Punched cards are ideal for storing the program. ***H. Cordes.*** *Brown Boveri Review*, v. 47, nos. 10-11, Oct.-Nov. 1960, p. 703-707.

* **Matching the Dynamic Characteristics of Turbines to the Requirements of System Control.** The article examines the dynamic response of different kinds of primary controllers for water turbines and states the conditions for mutually balancing the response of the various types of controllers actuated by a common correcting condition, and the circuit elements required to make parallel operation possible. A transistorized dynamic correction amplifier is described which has been in regular service for some time. ***H. Bloch.*** *Brown Boveri Review*, v. 47, nos. 10-11, Oct.-Nov. 1960, p. 750-757.

ELECTRICAL ENGINEERING

a

* **The Grounding of a Neutral in Overhead 6 - 10 kv Networks.** For sectionalizing purposes, when using pole switches with built-in protection more sensitive than the fuse links and multiple automatic reclosings, a dead ground of the neutral in 6 to 10 kw networks can be useful if the specific power resistance of the coils does not exceed 1.5 to 2.10^4 ohm-cm, or else high metal expenditure and network expenses will be involved. (*In Russian.*) O zazemlinii neitrali v vozdushnykh setiakh 6 - 10 kv. ***M. M. Feermark.*** *Energetik*, v. 8, no. 11, Nov. 1960, p. 12-16.

b

Annual Engineering Review for the Year 1960. Atomic power, turbines and generators, transformers, switchgear, measurements, dispatch, protection, drives and controls, motors and other problems are discussed. *Westinghouse Engineer*, v. 21, no. 1, Jan. 1961, 32 pp.

c

* **General Steady-State Theory of Cylindrical Magnetrons.** Space charge and the Maxwellian velocity distribution of the emitted electrons are taken into account, but the collisions between individual electrons are neglected. Explains the mathematical basis of the calculations and gives expressions for the volume density of the electrons and for the two components of the electron current density. ***P. A. Lindsay.*** *Journal of Electronics and Control*, v. 9, no. 4, Oct. 1960, p. 241-283.

d

* **An Electronic Digital Voltmeter.** Describes an electronic digital voltmeter, equipped with special distributor tubes .The voltmeter has a range of 0-1 volt with 1% accuracy. Measurements can be carried out at the rate of 100 times a second. ***J. L. J. van Vroonhoven and A. M. Muhlbaum.*** *Instrument Practice*, v. 14, Dec. 1960, p. 1317-1319.

e

* **For Maximum Economy in Energetic Oils.** Using a thermosiphon filter system with sorbents increases the life of oil in high and average power transformers. In the case of low power transformers (50 to 320 kw) this system means high efficiency of the sorbents, quality of the oil used, structural simplicity and reduced expenses of metal and money. The use of antioxidant additions is highly recommended. (*In Russian.*) Za maksimal'nuiu ekonomiiu energeticheskikh masel. ***A. P. Veselovskiĭ and M. G. Popovnin.*** *Energetik*, v. 8, no. 11, Nov. 1960, p. 3-9.

f

* **Errors of a System Used in Measuring Residual Current and Possibilities to Reduce Them.** The total error experimentally determined of the high precision measuring system described does not exceed 6%; a basic type of error is the nonlinear distortions. The low value of the total error was obtained owing to the rational design of the different elements of the system. (*In Russian.*) Pogreshnosti ustroĭstva dlia izmereniia ostatochnykh tokov i sposoby ikh umen'sheniia. ***A. I. Polter.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Energetika*, v. 3, no. 10, Oct. 1960, p. 47-52.

g

* **The Application of Multiplying Circuits in High-Voltage Experimental Systems.** Especially interesting was the use of these circuits in experimenting 20 and 35 kv cables. In their simplified form, these circuits permitted a decrease of the weight of high-voltage experimental systems and of the losses during fabrication. Due to semiconductor technics, these circuits have an interesting future. (*In Russian.*) Primenenie skhem umnozheniia v vysokovol'tnykh ispytatel'nykh ustanovkakh. ***G. I. Kitaev.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Energetika*, v. 3, no. 10, Oct. 1960, p. 32-39.

h

* **Switching Transistors.** The various methods used for predicting the performance of switching transistors are described and their validity under conditions of large collector current is discussed. Departures from the behavior predicted by simple theory have been found, and these are described in some detail. ***J. N. Barry.*** *Electronic Technology*, v. 37, Dec. 1960, p. 442-449.

i

What Electronics Can Do for Your Company. Research and development, production, process control, quality control, inspection, application of electronics are discussed. ***Art Zuckerman.*** *Dun's Review and Modern Industry*, v. 77, no. 1, Jan. 1961, p. 40-44.

j

k

* **Digital Tele-Operation Equipment Employing Semiconductors.** The digital-cyclic telemetering system, design and main properties, principles are discussed. ***G. F. Piazza and J. P. Cuendet.*** *Brown Boveri Review*, v. 47, nos. 10-11, Oct.-Nov. 1960, p. 723-731.

* **A Contribution to the Calculation of Pulse Transformers on Ring Ferrite Cores.** Description of a method for the design of low-power pulse transformers of this type, permitting well-defined optimum dimensions of the core according to the magnet wire consumption. The losses in the core are not taken into account. (*In Russian.*) K raschetu impul'snykh transformatorov na kol'tsevykh ferritovykh serdechnikakh. ***S. P. Mironov.*** *Elektrosviaz'*, v. 14, no. 11, Nov. 1960, p. 26-33.

* **Concerning a Direct Converter of Thermal Energy Into Electric Energy.** An electric current is obtained starting from ionized vapor. Any ionizing means, such as flames, U.V. light or radioactive elements may be used. The spatial distribution of the potential in the hot gas was compared with the electrodes. (*In French.*) Sur un convertisseur direct d'énergie thermique en énergie électrique. ***Siegfried Klein.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 22, Nov. 28, 1960, p. 2492-2495.

ELECTROCHEMISTRY

* **Natural Convection Mass Transfer at Vertical Electrodes Under Turbulent Flow Conditions.** The range studied included the region of transition from laminar to turbulent flow. With the tallest electrodes used (up to 1 m high), the limiting current density tends to become independent of height. It appears the transition to turbulent flow depends on the value of Schmidt number as well as the product Sc Gr. ***M. G. Fouad and N. Ibl.*** *Electrochimica Acta*, v. 3, no. 3, Oct. 1960, p. 233-243 + 4 plates.

* **Mass Transfer by Free Convection at Horizontal Electrodes.** Limiting currents were measured in an unstirred cell at cathodes facing upward. Variables were electrolyte composition, cathode sizes and the free height above the electrode. ***E. J. Fenech and C. W. Tobias.*** *Electrochimica Acta*, v. 2, no. 4, May 1960, p. 311-325 + 2 plates.

* **Studies on the Fluorine Generation by Fused Salt Electrolysis of KF-2HF at About 100°C.** Fluorine generation was studied from view points of anodic polarization and anode effect. Anodic polarization was proved to be related to the wettability of the anode by the electrolyte. Wettabilities of electrodes were measured and the relation between wettability and limiting current densities at which anode effect starts, was discussed. ***Shiro Yoshizawa, Nobuatu Watanabe, and Masahito Ishii.*** *Kyoto University. Memoirs of the Faculty of Engineering*, v. 22, pt. 4, Oct. 1960, p. 422-439.

* **An A.C. Bridge for Measurements in Electrochemical Systems.** The requirements from an ideal a-c bridge for making impedance measurements in electrochemical systems are a small a-c input voltage(1-5 mV), a wide frequency range (10 c/s-3 Mc/s), suitable balancing components and a sensitivity and precision of measurement of the order of 1%. A new bridge approximating the ideal is described, and its scope and limitations are discussed. ***G. C. Wood, M. Cole, and T. P. Hoar.*** *Electrochimica Acta*, v. 3, no. 3, Oct. 1960, p. 179-185.

* **Electrodeposition of Nickel-Cobalt Alloys. Russian Research and Development.** ***A. J. Steiger.*** *Metal Finishing*, v. 58, Dec. 1960, p. 53-55.

* **Nickel-Chromium Plated Aluminum Sheet. Atmospheric Corrosion Resistance.** Aluminum panels, plated with bright chromium by the zincate, Vogt, and phosphoric acid anodizing preplating processes were exposed outdoors in semi-rural and severe industrial atmospheres for up to two years. (To be continued.) ***R. C. Spooner and D. P. Seraphim.*** *Metal Finishing*, v. 58, Dec. 1960, p. 40 + 5 pages.

* **Zinc and Cadmium Plating.** Summary of British Standard Specification 1706: 1960 electroplated coatings of Cd and Zn on Fe and steel. *Electroplating and Metal Finishing*, v. 13, Dec. 1960, p. 458 + 2 pages.

* **Improved Nickel-Chromium Processes.** Summarizes the present methods used with the thought of corrosion resistance in mind. ***H. J. Bache.*** *Electroplating and Metal Finishing*, v. 13, Dec. 1960, p. 451-455.

* **Investigation of the Effects of Ultrasonic Vibrations on the Process of Chromium Electrodeposition.** The cathodic polarization in the interval of low current densities to the initiation of the Cr deposition on the cathode under the effect of ultrasounds is sharply decreased and does not change practically at higher current densities. The beginning of the deposition of metallic Cr in the ultrasonic field moves towards the side of higher current densities. (*In Russian.*) Issledovanie vliianiia ul'trazvukovykh kolebaniĭ na protsess elektroosazhdeniia khroma. ***A. M. Smirnova and N. T. Kudriavtsev.*** *Zhurnal Prikladnoĭ Khimii*, v. 33, no. 11, Nov. 1960, p. 2521-2526.

* **A Method of Electrolytic Solution of Stainless Steel.** The anodic solution of high chromium steels at high current densities (0.5-1 a/cm²) leads to the contamination of the anodic deposits by by-products of electrolysis. Conditions of electrolysis with low D.C. densities (0.03-0.05 a/cm²) securing a safe solution of stainless steel without the formation of these by-products were developed. (*In Russian.*) Metod elektroliticheskogo rastvoreniia nerzhaveiushcheĭ stali. ***V. A. Mchedlishvili, G. A. Liubimova, and A. M. Samarin.*** *Zavodskaia Laboratoriia*, v. 26, no. 11, 1960, p. 1212-1219.

The Resistance to Oxidation of Nickel-Chromium Electrodeposits on Molybdenum. Methods of electrodepositing Ni and Cr on cylindrical test-pieces of 0.5% titanium molybdenum alloy are described and the results of oxidation tests at 1100 C (2012 F) of various combinations and thicknesses of multilayer coatings of Ni and Cr are presented. ***C. Williams and R. A. F. Hammond.*** *Plating*, v. 48, Jan. 1961, p. 57-66.

Electrodeposition of Iron-Zinc Alloys From the Pyrophosphate Bath. A study was made of the effect of variables on alloy composition, cathode efficiency and cathode potential. ***Vasanta Sree and T. L. Rama Char.*** *Plating*, v. 48, Jan. 1961, p. 50-56.

Effects of Ultrasonics on Electrolytic Deposition of Copper From a Cyanide Bath. Application of ultrasonics resulted in large increases in anode and cathode current efficiencies, accompanied by large decreases in cell voltage. The relationship to current density is discussed, and the effectiveness of ultrasonic vibrations and mechanical agitation are compared. ***Charles B. Kenahan and David Schlain.*** *Plating*, v. 48, Jan. 1961, p. 37-41.

An Efficient Batch-Type Anodizing System. Automatic Control, Well-Engineered Equipment. Large tanks have the following advantages: larger parts may be handled, greater and smoother production, keep tanks more uniform, dragout and chemical impurities have less effect on solution concentration and load per lift may be increased without cost increase. ***Gilbert Tramer and Jack Lashkow.*** *Products Finishing*, v. 25, no. 4, Jan. 1961, p. 42-46.

Electrocleaning: A Report on Current Practice. Panel discussion on the hows and whys of electrocleaning with tips on improving results. *Products Finishing*, v. 25, no. 4, Jan. 1961, p. 50 + 6 pages.

Nickel Plate Cuts Buffing Costs. Leveling nickel fills in roughness that used to require buffing. *Products Finishing*, v. 25, no. 4, Jan. 1961, p. 76-79.

* **Conjoint Effects of Dietary Vegetable Fats and Cholesterol in Rabbits.** ***Joyce L. Beare, Harold C. Grice, and Clarence Y. Hopkins.*** *Journal of Nutrition*, v. 73, no. 1, Jan. 1961, p. 17-22.

ELECTRONICS

* **Effects of External Noise on Radar Performance.** Calculation of minimum detectable signal, equivalent antenna temperature, discrete sources of external noise, continuous sources

of external noise, calculation of maximum range and other problems are discussed. ***Robert L. Forward and Frances Richey.*** *Microwave Journal*, v. 3, Dec. 1960, p. 73-80.

Benefits of a New Aspect Ratio for Television. Defects in present system and proposed camera-aspect shift are discussed in detail. ***W. D. Schuster and C. E. Torsch.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 3, Nov. 1960, p. 13-17. (TK1 In6.6b Vis.)

A Television Sterophonic System. The method of compatible stereophony described is especially designed for use with the aural channel of a television broadcast system. Only one triode is required in the receiver demultiplexer. ***Robert B. Dome.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 3, Nov. 1960, p. 25-29. (TK1 In6.6b Vis.)

Power Sources for Low Heater Power Tubes in Transistorized Receivers. For most applications the horizontal output transformer core appears to be the most versatile choice, and offers a satisfactory solution to the problem. ***B. M. Soltoff and C. H. Tyson.*** *IRE Transactions on Broadcast and Television Receivers*, v. BTR-6, no. 3, Nov. 1960, p. 38-41. (TK1 In6.6b Vis.)

Radio Wave Propagation and Attenuation in the Troposphere. As the possible application of radio waves are further investigated the pressure on spectrum space becomes very great. Higher and higher frequencies are now coming into use and the estimation of the magnitude of microwave loss due to meteorological phenomena is important in further exploitation of the spectrum. ***E. M. Hickin.*** *Research Applied in Industry*, v. 13, Dec. 1960, p. 503-506.

* **Silicon Photo-Voltaic Cells for Instrumentation and Control Applications.** Describes the operation of Si *p-n* junction photo-voltaic cells as detectors of visible and near-infrared illumination. A brief account is given of the detection mechanism, with references to earlier papers, and the processes used in the fabrication of this type of cell are described. ***V. Magee and A. A. Shepherd.*** *British Institution of Radio Engineers, Journal*, v. 20, Nov. 1960, p. 803-820.

* **The Development of a High-Performance Tape Handler.** A number of forms of storage devices exist, but the greatest attraction of magnetic tape is the capacity of storage and the price per bit of stored information. This paper describes one way of achieving the development of a high-performance tape handler designed to reduce the severity of the problem of input and output rates. ***H. M. Harrison.*** *British Institution of Radio Engineers, Journal*, v. 20, Nov. 1960, p. 841-856.

The Degenerate and Quasi-Degenerate Mode of Parametric Amplification. Differential equations of the circuits, Mathieu and Hill equations, particular integral solution of Mathieu equation, derivation of a general expression, signal frequency response and other problems are discussed. ***P. Bura.*** *IRE Transactions on Circuit Theory*, v. CT-7, no. 3, Sept. 1960, p. 200-210. (TK1 In6.6c Vis.)

Ladder Transformer Coupling Networks for Pulse Amplifiers and Hard-Tube Modulators. The transformer and its network representation, step-down coupling networks, step-up coupling networks, experimental circuits are discussed. ***Thomas R. O'Meara.*** *IRE Transactions on Circuit Theory*, v. CT-7, no. 3, Sept. 1960, p. 239-246. (TK1 In6.6 Vis.)

Modern Low-Noise Amplifiers. I. Parametric Amplifiers. Resonant circuits and pendulums, pumping, practical variable parameters, parametric up-converters, practical parametric devices, limitations of parametric devices and other problems are discussed. ***G. D. Sims and I. M. Stephenson.*** *Discovery*, v. 21, Dec. 1960, p. 528-535.

* **Pulse Height Discriminator Employing Distributed Amplification.** An integral pulse-height discriminator employing distributed amplification is proposed. The discriminator accepts 0.5-12 volts positive input pulses with a maximum repetition rate in excess of 20 mc. Dead time is less than 25 mμ sec and threshold uncertainty is 30 mV. The circuit uses 20 vacuum-tubes in an arrangement believed to be new. ***C. Infante.*** *Nuclear Instruments and Methods*, v. 9, Oct. 1960, p. 102-106.

a • * **Kinematic Electron Bunching by Sinusoidal Travelling and Standing Waves in Short Extended Interaction Regions.** The Wessel-Berg theory is applied. The theory predicts a maximum fundamental r.f. current of 1.4 times the d.c. current for synchronous interaction, which may be increased a small amount for non-synchronous interaction. In order to check the validity of the theory, the equations of motion were integrated numerically on a high-speed electronic computer; the theory agrees well with these computations, if the electric field does not exceed a certain critical value. ***Hellmut Golde.*** *Journal of Electronics and Control*, v. 9, no. 4, Oct. 1960, p. 285-302.

b • * **Survey of Electronically Scanned Antennas.** Five major phase shifting techniques which meet high requirements are: the mechanical phase shifter, the ferrite phase shifter, the semiconductor phase shifter, the frequency conversion phasing scheme and the ferrite controlled radiating slot. ***Harold Shnitkin.*** *Microwave Journal*, v. 3, Dec. 1960, p. 67-72.

c • * **Control of the Amplitude and Phase of an Electromagnetic Wave in a Waveguide by Means of a Germanium Plate.** The Ge plate in the magnetic field actually has different conductivity for currents in different directions. If the dummy antenna past the plate is replaced by a section with a piston located a quarter wavelength from the plate, it is possible to obtain a large phase modulation with small values of reflection coefficient. ***N. V. Aleksandrov, E. M. Gershenzon, L. B. Gorskaya, and V. S. Etkin.*** *Microwave Journal*, v. 3, Dec. 1960, p. 87-88.

d • * **Electrostatic Focusing of Microwave Tubes.** The most important future problems are probably the development of better electron guns with less aberration, and a careful study of the region between gun and focusing system. There is no reason why a well designed electrostatic system should not equal or be superior to the best existing magnetic systems. ***J. R. Hechtel.*** *Microwave Journal*, v. 3, Dec. 1960, p. 81-86.

e • **Designing Grounded-Grid Amplifiers With Controlled Gain.** Grounded-gird triode amplifiers are suitable for automatic gain control and intermediate frequency circuits. ***J. W. Rush.*** *Electronics*, v. 33, no. 52, Dec. 23, 1960, p. 50-53.

f • * **On the Relation Between the Catalytic and Electric Behavior of p-Type Conducting Oxides.** The catalytic behavior of chromic and nickel oxides, respectively, was studied on the dehydrogenation and dehydration reactions of formic acid. The lowering of defect electron concentration of chromic oxide had a decreasing effect on the activity of the catalyst, and an increasing effect on the energy of activation. The diminution of conductivity of the catalysts is favorable for the dehydrogenation and vice versa. (*In Hungarian.*) Összefüggés a defektvezető oxidok elektromos és katalitikus sajátságai között. ***Zoltán Szabó and Frigyes Solymosi.*** *Magyar Kémiai Folyóirat*, v. 66, no. 11, Nov. 1960, p. 469-475.

g • * **Reciprocal and Nonreciprocal Phase Shifters in the Rectangular Waveguide.** The nonreciprocal phase shifter with ferrites is discussed by reference to results gained by experiment. The temperature compensation of the phase shift is dealt with in particular. Finally, the paper reports on the measuring method and the apparatus used. (*In German.*) Reziproke und nichtreziproke Phasenschieber im Rechteckhohlleiter. ***E. Pivit.*** *Frequenz*, v. 14, Nov. 1960, p. 369-378.

h • **Phase Modulation of T.W. Tubes.** The method of measurement, 1-Mc/s sawtooth generator, 1-kc/s-10-kc/s waveform generator are discussed. The phase-modulated traveling-wave tube may be used as a continuously rotating broad-band phase shifter with the added adavntages of no moving mechanical parts and a power gain and also as a manually-controlled phase shifter capable of 360° phase shift. ***R. H. Wadie, M. T. Stockford, and M. Hutchinson.*** *Electronic Technology*, v. 37, Dec. 1960, p. 466-474.

i • **Research on Oxide-Coated Cathodes.** Broadband telephone repeaters deep in the ocean (or deep in space) depend on complex reactions at the cathode of an electron tube to produce the electrons vital to amplification. Minute impurities in the nickel base of oxide-coated cathodes contribute significantly to both tube life and efficiency. ***H. E. Kern.*** *Bell Laboratories Record*, v. 38, Dec. 1960, p. 451-456.

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k •

* **Thermal and Optical Behaviour of Photo-Transistors.** Circuits were devised for one photo-transistor which allow relay operation in ambient temperatures up to 55 C. For precise position measurement, the optical-mechanical characteristics are not stable to better than ± 0.06 in., so that individual calibration is necessary to achieve a higher degree of accuracy. ***D. Shaw and B. Crump.*** *Electronic Engineering*, v. 32, Dec. 1960, p. 753-757.

* **Design and Development Problems of Radiation-Resistant High-Temperature-Tolerant Electronic Equipment Components.** Nuclear detectors that can operate reliably at elevated temperatures are being developed as reactor technology advances and improvements in materials allow higher and higher operating temperatures. ***J. Gray Stuart.*** *Applications and Industry*, 1960, no. 51, Nov., p. 339-341.

Measuring Parameters by Power Transistor Pulse Techniques. Method is to apply biases to the test transitor such that power is drawn in pulses of high peak value, but of sufficiently low duty cycle that the average power and resulting heating is small. Detections of the transistor's response signals are made and the d-c parameters obtained. ***Donald H. Breslow.*** *Electronics*, v. 34, no. 1, Jan. 6, 1961, p. 120-122.

Thyratron Monitors Line-Voltage Dips. Circuit senses and counts sudden line voltage dips below a present level. ***T. D. Koranye.*** *Electronics*, v. 34, no. 1, Jan. 6, 1961, p. 126.

* **News From the Universe by Radio Waves.** Surveys fundamentals and gives details about some fundamental findings of radio astronomy, especially about the continuous radio radiation within and outside the Milky Way, the 21-cm-emission of interstellar hydrogen, and the radio point sources of different kind. Refers to the radio radiation of the sun and other bodies in the solar system. (*In German.*) Kunde aus dem Weltall durch Radiowellen. ***Friedrich Becker.*** *ETZ: Elektrotechnische Zeitschrift*, v. 81, Ausgabe A, no. 24, Nov. 21, 1960, p. 841-848.

Recovery Technique for Saturated Masers. A method is described which was used in desaturating a four-level ruby maser. The saturation is caused by equalizing the populations of levels one, two, and three of the maser crystal by the leakage of the transmitter pulse, in addition to the action of the maser pump. The application of a desaturation pulse between levels one and four will then desaturate the maser. ***Gunter K. Wessel.*** *IRE Transactions on Electron Devices*, v. ED-7, no. 4, Oct. 1960, p. 297-302. (TK1 In6.6ed Vis.)

Radio Transmission Through the Plasma Sheath Around a Lifting Re-Entry Vehicle. Computations are made of the plasma conditions about simple-shaped bodies for the case of real-air, hypersonic, viscous flow. The magnitude of the peak plasma frequency at a given aft location is strongly dependent upon the bluntness of the body. It is concluded that signal frequencies of the order of 10 kmc are required to avoid sudden loss of communications during the critical part of a lifting re-entry hypersonic vehicle flight. ***Macon C. Ellis, Jr. and Paul W. Huber.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-507, Jan. 1961, 22 pp. (TL570 Un3t Room 290)

The Javelin Spike Antenna; Radiation Patterns and Voltage Standing-Wave Ratio. ***Roland R. Ford.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-565, Jan. 1961, 20 pp. (TL570 Un3t Room 290)

A Personal Two-Way VHF Radio Communication System Featuring Modular Construction. Defective modules can be rapidly replaced, and later repaired or modified. Other receiver features include one microvolt sensitivity, double conversion, a crystal filter selectivity package at the high I. F. frequency, and a novel squelch gating circuit. The companion transmitter, more conventional in construction, also is subminiaturized. ***T. H. Yaffe.*** *IRE Transactions on Vehicular Communications*, v. VC-9, no. 3, Dec. 1960, p. 44-47. (TK1 In6.6v Vis.)

Personal Radio Paging in the VHF Band. The system includes small light weight receivers which are worn by the users. The receivers can be selectively called up to many thousands on the same RF channel. The base station is a standard land mobile FM transmitter. This transmitter is tone modulated by the encoding equipment to send the page alerting call. ***John F. Mitchell.*** *IRE Transactions on Vehicular Communications*, v. VC-9, no. 3, Dec. 1960, p. 48-57. (TK1 In6.6v Vis.)

Design Characteristics of Nonvented Nickel-Cadmium Cells. The properties and operating characteristics of nonvented, rechargeable, Ni-Cd cells are determined and illustrated. The characteristics shown can be used to predict the performance of available sizes for circuit applications where a permanent, rechargeable dc power source is desired. ***Leonard M. Krugman.*** *IRE Transactions on Component Parts*, v. CP-7, no. 4, Dec. 1960, p. 129-131. (TK1 In6.6cp Vis.)

A Periodically Focused Backward-Wave Oscillator. An oscillator utilizing a hollow electron beam was constructed at S-band. A periodic electrostatic focusing method was used with considerable success, and an octave tuning range was obtained. A periodic magnetostatic focusing method was attempted. ***C. C. Johnson.*** *IRE Transactions on Electron Devices*, v. ED-7, no. 4, Oct. 1960, p. 274-279. (TK1 In6.6ed Vis.)

Klystron-Tube for Outer Space. Not only for outer space, but for its usefulness wherever microwaves must be generated, the importance of this tube grows with the industry's use of higher and higher frequencies. ***Tom Jaski.*** *Radio-Electronics*, v. 32, Feb. 1961, p. 46-49.

Multichannel Radio Communication Within the Army. The growth of Army multichannel communication systems from the radio-link equipment of the Tunisian campaign, through "backbone" radio relay employment exemplified by radio sets AN/TRC-1, AN/TRC-24, and AN/TRC-29, into tactical-mobile systems giving area coverage using AN/GRC-50, 53, 59, and 66 equipment is demonstrated. ***Lawrence G. Fobes.*** *IRE Transactions on Military Electronics*, v. MIL-4, no. 4, Oct. 1960, p. 505-513. (TK1 In6.6m Vis.)

Harmonic Generation by Means of Traveling-Wave Tubes. Shows that harmonics of a low frequency applied to one of the gun electrodes will be amplified by the helix and will appear at the output of the traveling-wave tube as a "picket fence" of RF signals. Describes the experimental techniques used and discusses the test results obtained. ***F. E. Kavanagh and K. Westermann.*** *IRE Transactions on Military Electronics*, v. MIL-4, no. 4, Oct. 1960, p. 493-496. (TK1 In6.6mi Vis.)

* **Non-Selective Effect of Light on the Surface Potential of Semiconductors and Especially of n-Type Germanium.** Dependency of the surface potential of semiconductors as a function of photons absorbed was discussed for two cases: The space charge and the charge of the ionized absorbed molecules are constant. Secondly, the space charge of the absorbed molecules modified by light, yet the balance between them remains the same. (*In French.*) L'action non sélective de la lumière sur le potentiel de surface des semi-conducteurs et spécialement de germanium type n. ***Aron Surduts.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 21, Nov. 21, 1960, p. 2329-2331.

ENGINEERING ECONOMICS

How to Look at Spending for Product Development. How engineers and upper management can co-ordinate viewpoints to gain a realistic appraisal of expenditures required for developing products. ***Philip Marvin.*** *Machine Design*, v. 32, Dec. 22, 1960, p. 94-99.

* **Totalitarian Controls Are Incompatible With Growth.** Argentina's Minister of Economy discusses the growth and improvement that has occurred in Argentina under the constitutional government which succeeded the dictatorship. ***Alvaro Alsogaray.*** *Industrial Development*, v. 129, no. 13, Dec. 1960, p. 6 + 5 pages.

* **MHE Guide to Receiving and Storing.** A guide to the best containers, dock layout, bin or slot storage, and yard receiving and storage. *Material Handling Engineering*, v. 16, no. 1, Jan. 1961, p. 37-52.

Profit Growth. No. 1 in 1961's *Management Series*, this article discusses the inroads that foreign competition, high wages, and plastics have made in the metal industries' profits. New improvements, inventions and exports will help the profit picture. *Steel*, v. 148, Jan. 16, 1961, p. 45-48.

What's Ahead for Depreciation? Present depreciation allowances are unsatisfactory for 63% of the large companies and 42% of the small companies. New legislation will probably not be enacted right away. *Steel*, v. 148, Jan. 16, 1961, p. 35-36.

FLUID MECHANICS

Relativistic Theory of Shock Waves. It is proved that entropy rises across a compressive shock and that the transition in the fluid velocity relative to a normally incident shock is from supersonic to subsonic. ***W. Israel.*** *Royal Society, Proceedings*, v. 259, ser. A, Nov. 22, 1960, p. 129-143.

Self-Induced Waves in a Conduit With Corrugated Walls. I. Experiments With Water in an Open Horizontal Channel With Vertically Corrugated Sides. With a narrow stream the waves possessed horizontal transverse crests and troughs, but above a certain width the waves were antisymmetrical. With different combinations of channels and corrugations, the mechanism was examined by which energy was taken from the stream to maintain the waves. Linings of rectangular capes and bays produced higher-order waves, and the effect was largely independent of the number of bays. ***A. M. Binnie.*** *Royal Society, Proceedings*, v. 259, ser. A, Nov. 22, 1960, p. 18-27 + 1 plate.

Formation of Thin Flat Sheets of Water. A thin plane sheet of fluid which is limited laterally and converges toward a point transforms itself into a sheet which diverges in a perpendicular plane. When the angle of convergence is small and the distribution of thickness in the converging sheet is elliptic the diverging sheet has the same shape as the converging sheet. Apparatus fro producing such a sheet was set up and the shape of the stream and distribution of pressure in the region of the transformation were measured and compared with calculations. ***Geoffrey Taylor.*** *Royal Society, Proceedings*, v. 259, ser. A, Nov. 22, 1960, p. 1-17 + 1 plate.

* **The Flow of Rarefied Gas Through a Curved Pipe.** The problem is treated in the region of free molecular flows at constant temperature. It is assumed that the motion is a steady one and the gas molecules striking the wall are reflected diffusely. The probability of molecule passing through the pipe which is proportional to the mass rate of flow is determined by solving approximately an integral equation. (*In Russian.*) Techenie razrezhennogo gaza cherez izognutuiu trubu. ***I. P. Otmakhova.*** *Moscow, Universitet, Vestnik, Seriia 1, Matematika, Mekhanika*, v. 15, no. 5, Sept.-Oct. 1960, p. 57-67.

Empirical Equation for Turbulent Forced-Convection Heat Transfer for Prandtl Numbers. Some of the experimental data and analyses applicable to convective heat transfer is reviewed. An empirical equation is evolved. The terms included in the equation are Reynolds number, Prandtl number, and an empirical diffusivity ratio between heat and momentum. ***Uwe H. von Glahn.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN*-D-483, Dec. 1960, 16 pp. (TL570 Un3t Vis.)

Dynamics of Compressible Fluids. Basic equations, discussion of the equation, characteristic solutions and simple waves, shocks, dimensionality and similarity, decay of shock pulse, inverted hydrodynamic equations, theory of viscosity, examples of viscous and conducting flows, some special problems are discussed. ***Francis H. Harlow.*** *U. S. Atomic Energy Commission, LA*-2412, Nov. 18, 1960, 200 pp. (UF767 U3La Contin.)

* **Effects of Some Parameters on Oil Displacement by Water in a Porous Medium.** Having had to deal with the wettability factor in the course of his experiments, the author gives a first outline of possible measurements. Parameters studied were length of structure and displacement velocity for a relatively narrow range of flow rates (1 to 10 ratio). Partial results obtained agreed with the literature. (*In French.*) Influence de quelques paramètres sur le déplacement de l'huile par l'eau dans un milieu poreux. ***P. Prudhomme.*** *Institut Français du Pétrole, Revue et Annales des Combustibles Liquides*, v. 15, Nov. 1960, p. 1575-1633.

Hydrodynamics and Propulsion of Submerged Bodies. The field of submerged bodies, such as combat or cargo-carrying submarines and torpedoes, is surveyed from the viewpoint of similarity considerations. The lift to drag ratio of the body is represented as a unique function of the Froude number, leading to corresponding relations for the ratio of machinery weight to total weight. There is a conflict between the requirements of low machinery weight and those of good efficiency and good cavitation resistance. ***George F. Wislicenus.*** *ARS Journal*, v. 30, Dec. 1960, p. 1140-1148.

Flow Visualization by Electrolysis of Water. Often an obscure flow phenomenon is readily understood, or a solution to a problem becomes obvious, once the flow is seen. If used intelligently, the technique can become a powerful aerodynamic tool, and tests are relatively inexpensive because of low model and visualization costs. ***Darwin W. Clutter and A. M. O. Smith.*** *Aero/Space Engineering*, v. 20, Jan. 1961, p. 24 + 6 pages.

FOOD TECHNOLOGY

* **Production of Edible Fish Flour From Oil-Sardine.** Edible fish flour, free from fishy odor, has been prepared from oil-sardine by subjecting the steam-cooked, pressed and dried fish meal to solvent extraction employing acetone, alcohol, benzene or hexane. ***K. Viswesweariah, J. R. Iyengar, M. N. Moorjani, and N. L. Lahiry.*** *Journal of Scientific & Industrial Research*, v. 19C, Nov. 1960, p. 285-286.

Radiation Preservation of Foods—Carbonyl Compounds of Irradiated Meats. In irradiated beef, pork, and chicken, isooctane-solube carbonyls come from the lipid, and aqueous-soluble carbonyls come from the protein. Irradiation of beef, pork, chicken, and beef liver gives rise to a wide variety of long-chain aldehydes and ketones. Carbonyls decrease during storage and cooking. ***K. J. Monty, A. L. Tappel, and H. S. Groninger.*** *Journal of Agricultural and Food Chemistry*, v. 9, Jan.-Feb. 1961, p. 55-58.

* **Heated Fats. II. The Nutritive Properties of Heated Cottonseed Oil and of Heated Cottonseed Oil Fractions Obtained by Distillation and Urea Adduct Formation.** ***Leo Friedman, William Horwitz, Glen M. Shue, and David Firestone.*** *Journal of Nutrition*, v. 73, no. 1, Jan. 1961, p. 85-93.

* **The Amino Acid Composition and Nutritive Value of Proteins. IV. Phenylalanine, Tyrosine, Methionine and Cystine Requirements of the Growing Rat.** ***P. B. Rama Rao, H. W. Norton, and B. Connor Johnson.*** *Journal of Nutrition*, v. 73, no. 1, Jan. 1961, p. 38-42.

FUELS AND COMBUSTION

* **Concerning the Industrial Combustion of Liquid Fuels.** Surveys light and heavy fuels from the point of view of their legal, usual, and complementary characteristics. Tries a practical approach to the problem of the amount of heat obtained by combustion in the unit of volume of a combustion chamber during a unit of time, and examines such elements as the thermal consumption and the theoretical and effective temperature of combustion. (*In French.*) A propos de la combustion industrielle des combustibles liquides. ***Jean François.*** *Chaleur & Industrie*, 1960, no. 424, Nov., p. 297-308.

Compatibility of Rocket Propellants With Materials of Construction. This report summarizes the available information on the compatibility of liquid rocket propellants with prominent materials of construction. It is pointed out that compatibilty data for materials not ordinarily covered by the Defense Metals Information Center are included. These data were found during

the search for information on materials that are within the scope of the DMIC, and are included for convenience. Fuels and oxidizers of current interest are discussed. The corrosion data which are presented will apply to storing, handling, and control equipment outside of missiles and to missile components up to the combustion chamber. Consideration also is given to such factors as catalytic decomposition and sensitivity to impact. ***W. K. Boyd and E. L. White.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 65, Sept. 15, 1960, 67 pp. (TN799 B32.2d Contin.)

Thermo-Gravimetric Studies on the Low Temperature Pyrolysis of Bituminous Coal. Results of studies on the thermal decomposition of a washed coal from Raniganj coal fields were carried out at steady temperatures ranging from 410-456 C by means of a thermal balance. ***P. Prabhakaram and H. P. S. Murthy.*** *NML Technical Journal*, v. 2, no. 3, Aug. 1960, p. 15-19.

* **The Gasification of Coal Fines.** Discusses apparatus for gasification. Flow sheets of system. Tabulated results. ***L. Jéquier, L. Longchambon, and G. Van De Putte.*** *Institute of Fuel, Journal*, v. 33, Dec. 1960, p. 584-591.

* **Development of the Production of Metallurgical Fuel From Brown Coal.** Describes recent work in Australia. The key development was the use of direct heating which allowed large quantities of heat to be transferred to the coal efficiently and without severe local overheating with benefit to both the yield and the quality of tar and the strength of the char residue. ***G. L. Kennedy.*** *Institute of Fuel, Journal*, v. 33, Dec. 1960, p. 588-608.

* **Ways of Expanding the Resources of Diesel Fuel.** From average fractions of high thermal cracking products, a high quality diesel fuel can be obtained. The quality of synthetic diesel fuels, other conditions being equal, depends to a large extent also on the physico-chemical properties of the cracking stock used for synthesis. (*In Russian.*) Puti rasshireniia resursov dizel'nogo topliva. ***M. G. Mamedli and M. S. Aliev.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Neft' i Gaz*, v. 3, no. 11, 1960, p. 79-82.

Kinetics of Combustion of Cyanogen and the Burning Velocities of Cyanogen-Oxygen-Nitrogen Mixtures. Velocities were measured by the tube and balloon methods. The results of these measurements were correlated with the Semenov-Zeldowitch-Frank-Kemmenetsky thermal theory of flame propagation, and also with the Tanford-Pease theory. ***Emile Rutner, Karl Scheller, and William H. McLain, Jr.*** *Journal of Physical Chemistry*, v. 64, Dec. 1960, p. 1891-1896.

* **A Contribution to the Study of Gas Manufacture on the Basis of Light Distillates.** Systematic laboratory tests and pilot plant application of the P9 method, respectively described in two sections, make it possible to define the values of the different parameters affecting the compositions and characteristics of the gases manufactured from such light distillates, and also to determine optimum production conditions for the gases it is sought to obtain. (*In French.*) Contribution a l'étude de la production de gaz a partir d'essences légères. ***A. Salvadori, P. Lovy, and M. Beigelman.*** *Institut Français du Pétrole, Revue et Annales des Combustibles Liquides*, v. 15, Nov. 1960, p. 1664-1699.

Rubber Pump Wall Is Seal and Spring Too. Multipurpose ring eliminates costly machining in fuel injection pump. *Product Engineering*, v. 32, no. 2, Jan. 9, 1961, p. 60-61.

* **Modern Research Technique in Fuel Refining.** Surveys the advantages of basic methods such as the fixed bed, moving bed, fluidized bed, and diluted phase fluid bed processes, and new developments in petrochemistry, gasoline synthesis, and coal refining by means of drying, degassing and gasifying methods. (*In German.*) Neuzeitliche Verfahrenstechnik in der Brennstoffveredlung. ***Helmut Pichler.*** *Glückauf; Bergmännische Zeitschrift*, v. 96, no. 25, Dec. 3, 1960, p. 1597-1603.

Stabiliser Degradation in Picrite Propellants. Propellants were artificially aged at 65 C and the rate and manner of decomposition were followed by separation and analyses of the products derived from the stabilizer due to its combination with nitrogen oxides. ***Paul E. Gagnon, R. MacDonald, C. Haggart, and J. L. Myers.*** *Journal of Applied Chemistry*, v. 10, pt. 2, Nov. 1960, p. 445-449.

a * **Aerojet Forecasts Liquids for 60's.** High specific impulse and long-burning time make liquid propellants attractive for booster and "in-space use"; payload cost reductions in orders
• of magnitude possible this decade. ***J. C. Moise.*** *Aircraft & Missiles*, v. 4, Jan. 1961, p. 54-56.

b * **Literature Pertaining to the Art and Science of Oil Burning for Residential Applications.** A review of technical literature and compilation of abstracts prepared as a guide to ref-
• erences for the use of research investigators and designers in the field of oil-burning equipment. Sixteen broad subject classifications are each prefaced by an introductory review and each contains brief abstracts of pertinent references. Included are such subjects as fuel-oil atomization, ignition, physics and chemistry of combustion, fuel-air mixing and recirculation, c surface combustion, chimneys, equipment developments, and standards. Although primary emphasis is placed on low-capacity oil burners, much of the material applies broadly to combustion
• and to larger oil-burning equipment. The publication was compiled by Battelle Memorial Institute as part of a research study for the API Fuel Oil Committee. ***C. F. Speich and D. W. Locklin, compilers.*** API Publication No. 1537. 110 pp. Jan. d 1960. American Petroleum Institute, New York. (TH7466.06 Am36.5L Ref.)

• **The Burning to Detonation of Solid Explosives.** Combustion is initiated when a thermal explosion is produced at one end of a column. If the combustion proceeds by a conductive mechanism of energy transfer, the maximum combustion velocity e obtainable is of the order of 1 m./sec. ***N. Griffiths and J. M. Groocock.*** *Chemical Society, Journal*, 1960, Nov., p. 4154-4162.

• * **Some Relationships of the Quality Parameters of Coke.** A study of the properties of commercial and laboratory coke, based on the results of X-ray examination, microscopic analysis, determination of specific surface, heat of wetting, differential thermal analysis, thermal gravimetric analysis in an oxidizing f medium, and conductivity. (*In German.*) Einige Beziehungen der Qualitätsparameter von Koks. ***M. F. Kessler and V. Večeřiková.*** *Brennstoff-Chemie*, v. 41, no. 12, Dec. 1960, p. 369-374.

• * **Fuel-Nozzle Temperature Measurement.** Research on this topic is dependent upon a practical and accurate method of dynamic temperature measurement. ***A. J. V. Joseph.*** *Engineering*, v. 190, Dec. 2, 1960, p. 762-763. g

• **More Punch for Solid Propellants.** Hercules Powder Company is planning new compositions of solid propellants. The plant will work to raise the power and lower the cost of solid propellants. *Chemical Week*, v. 88, no. 2, Jan. 14, 1961, p. 35 + 2 pages.

h * **The Kolbe Electrolysis—Current Problems.** ***G. W. Thiessen.*** *Record of Chemical Progress*, v. 21, no. 4, Dec. 1960, p. 243-255.

• * **Time-Concentration Diagram of Electrolytic Baths.** Deals with a mathematic method expressing changes taking place in electrolytic baths and effecting their concentration. Two examples, baths for chromate treatment and phosphating, indicate i the practical application of theoretical deductions. (*In Czech.*) Časový průběh koncentrací lázní na povrchové úpravy. ***Z. Krejčí.*** *Strojírenství*, v. 10, no. 11, Nov. 1960, p. 838-842.

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GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

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• * **Determination of the Workability of a Coal Face Underground by Measuring the Friability of Coal.** Results of an investigation of the friability-index of coal face underground, which would be the most useful index for prediction of face k workability, at 141 working faces (62 coal mines) in Japan are described. ***Toshio Aida and Takashi Okamoto.*** *Kyoto University. Memoirs of the Faculty of Engineering*, v. 22, pt. 4, Oct. 1960, p. 387-400.

* **An Elastic Treatment of Ground Movement Due to Mining. I. Isotropic Ground.** So long as the excavation is comparatively deep the seam thickness may be considered infinitesimal and the convergence of opposing points in roof and floor may be treated as a discontinuity in displacement at a single point. A result in plane elasticity can then be used to find the solution for a partially closed excavation of infinite length in an infinite medium, and from this solution are derived those for an unclosed and a completely closed panel. ***D. S. Berry.*** *Journal of the Mechanics and Physics of Solids*, v. 8, no. 4, Nov. 1960, p. 280-292.

* **Formation of Asphalts From Petroleum Cracking Residues of Natural and Synthetic Origin.** The coagulation of asphalts is accompanied by a mechanical entrapment of oils and tar; thus, the yield of asphalts, when formed by single extraction, is increased twofold. A four-stage purification of the extractants guarantees practically pure asphalts. A single process of asphalt coagulation by means of commercial isooctane produces purer asphalts than the single extraction process. (*In Russian.*) Vydelenie asfál'tenov iz neftianykh ostatkov prirodnogo i destruktivonogo proiskhozhdeniia. ***M. E. Levinter and M. I. Medvedeva.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Neft' i Gaz*, v. 3, no. 11, 1960, p. 61-66.

* **Meteorites in the Light of Modern Metallurgy.** Classification and formation. ***K. S. B. Rose.*** *Australasian Engineer*, v. 52, Oct. 1960, p. 53-61.

Cosmic Ray Measurements and Measuring Devices. Literature search on. Periodical and report literature published on cosmic rays with emphasis on Čerenkov radiation. ***Ester Pereira, editor.*** 83 pp. 1960. California Institute of Technology, Pasadena. (QC485 As89c Ref.)

* **Oil May Be Found in Any Type Rocks.** A theory of how hydrocarbons migrate and accumulate hinges on a premise that hydrocarbons have been generated continuously in all oceans of the world throughout geologic time. *Petroleum Week*, v. 11, no. 26, Dec. 30, 1960, p. 26 + 2 pages.

* **Method of Calculation of Recoverable Oil Reserves in the Final Stage of Exploitation of Oil Strata Under Conditions of Displacement of Oil by Water.** ***M. I. Maksimov.*** *Petroleum Geology*, v. 3, no. 3-B, 1959, p. 181-187.

* **On Geomagnetic Observations With the Aid of the First Soviet Space Rocket.** Investigations of the geomagnetic field revealed that the measured field intensity decreases with the height more rapidly than the one calculated (field intensity of the geomagnetic dipole), reaching a minimum at 400γ ($1\gamma = 1 \times 10^{-5}$oerst.) at 20,800 km from the earth's center. Then it increases to 800γ at 22,000 km; farther on, it slowly decreases. (*In Russian.*) K voprosu o geomagnitnykh nabliudeniiakh na pervoĭ sovetskoĭ kosmicheskoĭ rakete. ***M. G. Antsilevich and A. D. Shevnin.*** *Akademiia Nauk SSSR, Doklady*, v. 135, no. 2, Nov. 1960, p. 298-300.

* **Experimental Investigations of the Coefficient of Water Displacement in Connection With the Underground Oil Conservation in Water-Bearing Structures.** The coefficient studied depends upon the filtration rate of water displaced by the oil and upon the motion rate of the border zone of the oil-water mixture. It decreases rather sharply with the increase of the values of these characteristics, especially in the case of low values. It increases with the increase of the angle of incidence of the seam in the case of a downward motion of the oil-water boundary zone. (*In Russian.*) Eksperimental'nye issledovaniia koeffitsienta vytesneniia vody gazom v sviazi s podzemnym khraneniem gaza v vodonosnykh strukturakh. ***A. L. Khein, S. N. Buzinov, and P. Ia. Altukhov.*** *Gazovaia Promyshlennost'*, v. 5, no. 11, Nov. 1960, p. 27-32.

* **Displacement of Oil by Rich-Gas Banks.** In the regions contacted by the gas, a small bank of an oil-miscible gas driven by CH_4 can displace all of the oil in a piston-like manner. ***C. W. Arnold, H. L. Stone, and D. L. Luffel.*** *Journal of Petroleum Technology*, v. 12; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 219, Dec. 1960, p. 305-312.

Unusual Recordings of Infrasonic Disturbances in the Atmosphere. Studies were made of the quantitative relation between the source of the disturbance and the incident sound pressure, the direction of approach of the incident wave, and the speed of the wave across the earth's surface. *National Bureau of Standards, Technical News Bulletin*, v. 44, Dec. 1960, p. 206-208.

* **Meteoritic Abundance of Ruthenium.** The Ru content of 15 chondrites (all "finds") averaged 1.0 p.p.m., with a range from 0.7 to 1.3 p.p.m. The metal phase of chondrites contains, on the average, 4-5 p.p.m. Ru, and the troilite phase a similar amount. Ruthenium varies widely in iron meteorites, the range of 17 extending from less than 1 p.p.m. to 15 p.p.m., with an average of approximately 7 p.p.m. ***T. Hara and E. B. Sandell.*** *Geochimica et Cosmochimica Acta*, v. 21, nos. 1-2, Dec. 1960, p. 145-150.

* **Microseisms at Scott Base.** The seasonal variation of pack ice surrounding the Antarctic continent has a great effect on the levels of microseismic activity at Scott Base. Microseismic storms are in general of two types, one with periods 1 to 3.5s, the other with periods 4 to 10s. The short-period activity is due to events within the Ross Sea and is at a maximum during Jan. and Feb. when the Ross Sea is clear of ice. The long-period activity has a maximum during Mar. and Apr. and this is thought to be due to swell from peripheral cyclones penetrating the Ross Sea and creating microseisms after passing the continental shelf. ***T. Hatherton.*** *Geophysical Journal*, v. 3, no. 4, Dec. 1960, p. 381-405.

* **The Time Term Approach to Refraction Seismology.** In all seismic refraction surveys, the problem is to determine the constants in a system of equations of the type $t_{ij} = a_i + b_j + \Delta_{ij}/v$ where a_i and b_j are "time terms" which are characteristic of the shot-point and seismograph station respectively, Δ_{ij} is the distance between the shot point and the seismograph, t_{ij} is the time of propagation of a refracted wave and v is the velocity of propagation of seismic waves in an underlying marker layer. ***P. L. Willmore and A. M. Bancroft.*** *Geophysical Journal*, v. 3, no. 4, Dec. 1960, p. 419-432.

* **On the Exchange of Carbon Dioxide Between the Atmosphere and the Sea.** Processes responsible for exchange of CO_2 are analyzed. Shows that the rate of transfer is considerably decreased due to the finite rate of hydration of CO_2 in water both for a smooth water surface where molecular diffusion plays a role in the first few hundredths of a millimeter as well as for a rough sea. ***Bert Bolin.*** *Tellus*, v. 12, no. 3, Aug. 1960, p. 274-281.

* **Radiance Distribution in the Upper Layers of the Sea.** The angular distribution of underwater radiance for green light has been studied in the upper turbid layers by means of a radiance meter which is lowered in the sea along a guide wire with a fixed orientation. ***N. G. Jerlov and M. Fukuda.*** *Tellus*, v. 12, no. 3, Aug. 1960, p. 348-355.

Some Possible Operations on the Moon. Astronauts who intend to "live off the land" on the moon, must produce out of its constituents O and N for breathing, water and certain elementary foodstuffs for living, shelters for protection and mechanical and electric power for all of the desired activities of construction and of locomotion. ***F. Zwicky.*** *ARS Journal*, v. 30, Dec. 1960, p. 1177-1181.

* **Preliminary Observations of Polarization of 21 cm Radiosources.** (*In French.*) Observations préliminaires de la polarisation des radiosources sur 21 cm de longueur d'onde. ***Jean Barat, James Lequeux, and Émile Le Roux.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 22, Nov. 28, 1960, p. 2476-2478.

* **Experimental Migration of Iron in Marine Deposits.** Sea slime of high argile concentration was placed in aquaria and covered by a thin layer of sea water treated with 1% glucose. After a time, according to the bacterial activity, Fe migrated from the sediment into the surface liquid, in a colloidal or dissolved form. The form of Fe in the sediment, its mode of transportation, and the amount that can thus be liberated is studied. (*In French.*) Migration expérimentale du fer dans les sédiments marins. ***Maurice Gennesseaux.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 22, Nov. 28, 1960, p. 2564-2565.

* **Weather Satellites.** The successful launching and operation of the first real experimental weather satellite, Tiros I, has indicated that the principles and fundamental theories involved are sound. Preceding Tiros I were high-altitude research rockets and scientific satellites equipped with cloud-cameras and infrared apparatus for measuring the heat balance of the earth. (*In Norwegian.*) Vaersatellitter. ***Erik Tandberg.*** *Teknisk Ukeblad*, v. 107, no. 46, Dec. 15, 1960, p. 1035-1044.

Origin and Nature of Lunar Surface Features. *J. J. Gilvarry.* *Nature*, v. 188, Dec. 10, 1960, p. 886-891.

* **Helium . Its Increased Use and Importance. *Paul V. Mullins.*** *Gas*, v. 37, Jan. 1961, p. 57-62.

* **Waterflood Performance in Stratified Reservoirs. *R. V. Higgins and A. J. Leighton.*** *Mines Magazine*, v. 50, Nov. 1960, p. 50-54.

* **Oil Recovery by Thermal Methods.** Current knowledge based on theoretical and laboratory research as well as on field tests furnishes guideposts for planning a thermal recovery project. ***Stephen E. Szasz.*** *Mines Magazine*, v. 50, Nov. 1960, p. 32-36.

Oil Stands to Gain From the Mohole. *Frank J. Gardner.* *Oil and Gas Journal*, v. 59, no. 3, Jan. 16, 1961, p. 119.

* **How Kerr-McGee Is Drilling 710 Feet of 90-Inch Hole.** This oil country rig is moving as much rock as it would have cut in drilling a 12-inch hole to 40,000 feet. ***Bob Farson.*** *Drilling*, v. 22, Jan. 1961, p. 50 + 3 pages.

* **How Rotary Drilling Speeds Shaft Sinking.** Kermac Nuclear drills four shafts at Ambrosia Lake totaling 2,862 feet in 10 weeks. Average cost for drilling 44-inch hole and hanging 36-inch casing was $48 per foot. ***Floyd Ray and Gerald O. Atkinson.*** *Mining World*, v. 23, no. 1, Jan. 1961, p. 23 + 3 pages.

* **The Deep Water Circulation in the Southwest Indian Ocean.** The "core method", together with geostrophic computations, is used to make a tentative interpretation of the circulation. ***Xavier Le Pichon.*** *Journal of Geophysical Research*, v. 65, no. 12, Dec. 1960, p. 4061-4074.

Near Infrared Atmospheric Transmission to Solar Radiation. Near infrared solar spectrum observations taken on Oct. 15, 1954, with a double-pass NaCl prism spectrometer have been analyzed for transmission coefficients of the "selective" absorption factor and for the "continuum" factor. The analysis was carried out for 59 wavelength positions between 0.872 and 2.537 μ. The monochromatic data fit well the law $^{\circ}nT = c_1(w)^{\frac{1}{2}}$ where w is the amount of water vapor in the optical path. ***David M. Gates.*** *Optical Society of America, Journal*, v. 50, Dec. 1960, p. 1299-1304.

* **Freezing of a Supercooled Drop of Water to a Single Crystal Granule.** Results show that the freezing of the supercooled drop can be of two kinds. In some cases granules may be opaque very fine air bubbles. These granules are formed on strong supercooling. In other cases, granules are transparent. They are formed at a lower velocity. The formation of a single-crystal granule on freezing of a supercooled drop is an unexpected fact which indicates that under certain conditions the crystallization of the volume of a small drop proceeds in a strong order, which contributes to the formation of single crystals. Multiple investigations show that the optical axes of a single-crystal granule of ice are usually of an arbitrary direction. (*In Russian.*) Obrazovanie monokristal'noĭ granuly l'da pri zamerzanii pereokhlazhdennoĭ kapli vody. ***N. V. Gliki, A. A. Eliseev, and N. M. Marchenko.*** *Akademiia Nauk SSSR, Doklady*, v. 135, no. 3, Nov. 1960, p. 591-594 + 1 plate.

* **Origin of the Sodium Airglow.** Suggests that the airglow results from collisions of neutral atomic Na with vibrationally excited O. ***Andrew E. Potter, Jr. and Betty S. Del Duca.*** *Journal of Geophysical Research*, v. 65, no. 12, Dec. 1960, p. 3915-3923.

* **On a Sensitive Method for the Recording of Atmospheric Ozone.** The sensitivity of the device is extremely high and the response is instantaneous. Since there are no liquid chemicals, the method can be used at extreme heights in the atmosphere and for continuous monitoring of ozone near the earth's surface. ***Victor H. Regener.*** *Journal of Geophysical Research*, v. 65, no. 12, Dec. 1960, p. 3975-3977.

* **The Coalescence of Water Drops in an Electric Field.** The effective radius of the drop can become 30% greater than the geometrical drop radius when interactions take place in electric fields between 1 stat volt/cm and 10 stat volts/cm. ***George Freier.*** *Journal of Geophysical Research*, v. 65, no. 12, Dec. 1960, p. 3979-3985.

American Standard Practice for Rock-Dusting Underground Bituminous-Coal and Lignite Mines to Prevent Coal-Dust Explosions (ASA Standard M13.1-1960, UDC 622.81). To achieve full benefits, rock dust must be applied properly and be maintained satisfactorily. Contains recommended practices for the use of rock dust and definitions of the terms employed. *U. S. Bureau of Mines Information Circular* 8001, 1960, 5 pp. (TN21 Un3i Room 290.)

GRAPHIC ARTS

* **High-Speed Photography in Aerodynamic Research at the National Physical Laboratory.** A brief account is given of some of the applications of high-speed photography and optical methods of flow-visualization to recent work in the wind-tunnels and shock-tubes of the Aerodynamics Division of the National Physical Laboratory. The examples shown are a simulated boiler-tube experiment, an aileron-buzz experiment, color-schieren and polarization-interferometer photography of transonic flows and others. ***R. J. North.*** *Journal of Photographic Science*, v. 8, no. 6, Nov.-Dec. 1960, p. 223-231.

Use of a Modified MacMichael Viscometer for Consistency of Printing Inks and Ink Vehicles. *R. Cummings.* *ASTM Bulletin*, no. 250, Dec. 1960, p. 49-50.

* **Pictorial Reproduction.** Discusses the flexographic process and its pictorial achievements, as they have progressed during the past 20 to 30 years to the present state of development; then explores the possibilities for the future of pictorial reproduction by flexography. ***Douglas E. Tuttle.*** *Flexography*, v. 5, no. 12, Dec. 1960, p. 10-13.

Two High-Speed Color Films and a Reversal Print Film for Motion-Picture Use. Eastman Ektachrome ER Daylight and Type B Films are high-speed color reversal camera films. Ektachrome Reversal Print Film, designed for the same process as the camera films, may be used for making high-quality prints from camera originals. ***N. H. Groet, T. J. Murray, and C. E. Osborne.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, Nov. 1960, p. 815-817.

Focal-Plane Shutters and the Design of High-Frame-Rate Cameras. Operating principles for a new family of rotating-mirror framing cameras which make use of focal-plane shutters are described and examples are given. The basic concept is an extension of the idea of isotransport of image and film, presently found only in moving-film cameras. The rotating mirror and a number of prisms, plane mirrors or concave mirrors are used to produce a sequence of connected frames which move past a fixed slit in the camera at constant velocity. The moving image segments seen through the slit are then relayed to a stationary film by means of a smear camera employing the same rotating mirror. The optics of the smear camera is arranged to stop the motion of each image on the film. As a consequence, a series of stationary images which have been scanned by a focal-plane shutter in a known way are formed on the film. ***Sigmund J. Jacobs.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, Nov. 1960, p. 801-807.

* **A Sensitometer and Automatic Recording Densitometer for Colour Films.** The measurement of the different characteristics of an emulsion and the study of the connection between its various properties, such as sensitivity, exposure range, contrast, resolving power, fog, etc., has been customary for black-and-white material for a long time. The development and improvement of the color film make sensitometric control still more imperative, owing to the greater complexity of this material.

A. Thiels. *Journal of Photographic Science*, v. 8, no. 6, Nov.-Dec. 1960, p. 236-243.

* **Roll Film Camera and Printing Productivity.** Litho and photoengraving galleries cut waste, save time and materials through use of roll film and roll-film cameras. ***A. J. Powers.*** *Printing Production*, v. 91, no. 4, Jan. 1961, p. 54-57.

* **Four Printing Processes Give Volume Production With Flexibility.** Operation by letterpress, offset, gravure, and flexography is described. ***MacD. Sinclair.*** *Printing Production*, v. 91, no. 4, Jan. 1961, p. 48 + 4 pages.

* **An Alternative to Dot Etching.** A method for changing dot values by varying exposure durations is described. ***Edward Glauder.*** *National Lithographer*, v. 68, Jan. 1961, p. 28-29.

Kerr Cell Framing Camera. A single Kerr cell, pulsed once, is used in conjunction with a system of optical delays to provide six consecutive pictures at interframe times of 1.5×10^{-8} sec and exposure times of 5×10^{-9} sec. The camera is f/10 at the 35 mm film plane and the pictures have roughly 240x600 information lines content. ***Willis C. Goss.*** *Society of Motion Picture and Television Engineers, Journal*, v. 69, pt. 1, Dec. 1960, p. 889-891.

HEAT POWER

* **Experiments of Development of "Membrane Cells".** Hydrogen-oxygen fuel cells using solid ion-exchange membranes as electrolyte were constructed by selecting suitable catalysts. These cells work at room temperature and require gas pressures slightly above atmospheric pressure. The most efficient type has an open-circuit voltage of 1.03 V, and at 0.65 V a current of 10 mA/cm² can be drawn. (*In German.*) Versuche zur Entwicklung von "Membranelementen". ***E. Joachim and W. Vielstich.*** *Electrochimica Acta*, v. 3, no. 3, Oct. 1960, p. 244-252.

* **Technico-Economic Characteristic of a Continuous Heating Gas Turbine.** In a turbine of this type, the optimum parameters and highest degree of regeneration can be determined on the basis of a combination of the thermodynamic considerations involving economic indices. These factors must be connected with a minimum of annual service and capital losses. For this purpose some expressions and graphics were proposed. (*In Russian.*) Tekhniko-ekonomicheskaia kharakteristika gazovoĭ turbiny nepreryvnogo goreniia. ***Evgeniĭ Khadzhipetrov.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Energetika*, v. 3, no. 10, Oct. 1960, p. 67-87.

Magnetohydrodynamic Power Generation. Magnetohydrodynamic power generation could well be the solution in the search for higher thermal efficiencies. Besides the advantage of higher efficiencies resulting from operation at high temperatures, generators of this type would have a reduced weight due to fewer and more compact components, higher reliability as they contain no moving parts, lower capital costs and fuel costs, and would relieve cooling water and sitting problems. ***R. Hawley.*** *Research Applied in Industry*, v. 13, Dec. 1960, p. 466-472.

* **New Scope for Utilising Solar Energy.** Between the latitudes 45°N and 50°S sufficient radiation is received on the earth's surface to warrant the direct utilization of solar energy. Flat-plate and focusing heat collectors are currently in use. ***Stephen A. Vincze.*** *Engineering*, v. 190, Dec. 16, 1960, p. 824-825.

* **The Optimum Size of a Rocket Engine.** Studies were made to determine the relationship between the specific weight and thrust of a liquid bi-propellent rocket engine. The minimum specific weight is achieved at a thrust level near 50,000 lb. The difference in specific weight between engines of 200,000 lb thrust and 50,000 lb thrust is only about 10% and this is shown to be equivalent to only 1% in propellent specific impulse. Although small, it is considered significant that a minimum has been established and this fact is used as an argument to justify the use of clusters of engines (generally four) to provide levels of thrust greater than 100,000 lb. ***J. E. P. Dunning.*** *Royal Aeronautical Society, Journal*, v. 64, Dec. 1960, p. 717-742.

Selection of High Performing Propellants for Torpedoes. The selection of chemical propellants for heat engines of underwater missiles is discussed on the basis of the maximum performance available. Here it is evident that reactions in which "free" sea water is both oxidant and diluent provide the best performance, and Al and Zr may be the best fuels. Possible methods are mentioned for bringing about the necessary chemical reactions. ***Leonard Greiner.*** *ARS Journal*, v. 30, Dec. 1960, p. 1161-1163.

Some Aspects of Underwater Jet Propulsion Systems. Various underwater jet engines—the hydroduct, or ramjet, the hydropulse, the hydroturbojet, and the rocket, both solid and liquid—are described and discussed for underwater applications. Because of the increasing importance of deep operation, the solid rocket is becoming more significant. The limit of speed imposed by the body cavitation phenomenon is discussed. ***C. A. Gongwer.*** *ARS Journal*, v. 30, Dec. 1960, p. 1148-1151.

* **Propulsion Units for Supersonic Transport Aircraft.** Turbojet engines with and without afterburning facilities and turbojets combined with ramjets are considered both in connection with, and from the viewpoint of, their adaptation to suitable airframes. The performances obtainable are shown in terms of shares of payloads at airspeeds of Mach 2, 3, and 4.5. This paper also deals with questions relating to the best way of fitting propulsion units and their operation. (*In German.*) Triebwerke für Überschall-Verkehrsflugzeuge. ***R. R. Jamison and R. J. Lane.*** *Luftfahrttechnik*, v. 6, Dec. 1960, p. 345-361.

* **Optimum Designs of By-Pass Turbojets.** It is demonstrated that, given certain mass relationships, with the use of a given type of gas producers and under certain conditions of gradient distribution, maximum thrust values are obtained from cold and heated by-pass turbojets. The conditions requisite for the achievement of maximum values and of the potential rate of thrust augmentation in cold or heated by-pass turbojets as compared with a simple turbojet represented by a gas producer are deducted. The results of detailed calculations are given. (*In German.*) Optimalauslegungen von Zweikreisstrahlturbinen. ***Hermann Hagen.*** *Luftfahrttechnik*, v. 6, Dec. 1960, p. 338-345.

* **Experimental Investigation of the Combustion Processes in the Circular Combustion Chamber Sector of a Turbo-Jet.** The fuel droplet distribution in an annular turbo-jet combustion chamber is studied by high-speed microphotography and the flame is analyzed by spectroscopy. The effect of the various parameters has been studied and the variation of the combustion efficiency with equivalence ratio has been interpreted. (*In German.*) Experimentelle Untersuchung der Verbrennungserscheinungen in einem Ringbrennkammersektor eines Turbinenstrahltriebwerks. ***R. Kling.*** *Zeitschrift für Flugwissenschaften*, v. 8, Dec. 1960, p. 345-352.

* **Outlines of the Present Problems Raised by the Ramjet and by Its Association With Turbo-Machines.** A historical development of the idea is given, starting with 1913. The combustion chamber, structures, materials, and the propulsion of supersonic transport are described. (*In French.*) Aperçus sur les problèmes actuels posés par le statoréacteur et par son association avec les turbomachines. ***Albert Gozlan.*** *Technique et Science Aéronautiques*, 1960, no. 4, July-Aug., p. 255-267.

Thrust Reversers for Jet Aircraft Selection and Design. Pertinent factors in the design of a thrust reverser for a given jet aircraft are discussed, and typical performance data is surveyed. With new and better high-temperature alloys becoming available, lighter weight, more reliable thrust reverser service may be expected in the future. ***John C. Pickerd.*** *Aero/Space Engineering*, v. 20, Jan. 1961, p. 30 + 7 pages.

Free Turbine Systems in Rotary Wing Aircraft. A comparison of four different power-plant systems, incorporating a free turbine, as applied to rotary wing aircraft, is given. Considered were ratio of free turbine shaft horsepower to primary gas flow rate, main compressor-turbine shaft horsepower, specific fuel consumption, airflow ratio, duct pressure and temperature. ***Henry F. Hrubecky.*** *Aero/Space Engineering*, v. 20, Jan. 1961, p. 10-13.

A New Type of Thermal Radiator for Space Vehicles. A rotating belt radiator, operating on a heat capacity principle, is described which can supplant conventional tube-and-header

designs to good advantage from a weight and meteoroid vulnerability viewpoint, especially at mw power levels. Meteoroid impacts and high inertial loads do not affect the belt radiator. ***Roger C. Weatherston and William E. Smith.*** *Aero/Space Engineering*, v. 20, Jan. 1961, p. 16 + 8 pages.

HUMAN FACTORS

Sierra Sam: Scientific Whipping Boy. A well-known manlike test dummy works closely with some of the nation's top engineering talent in critical military projects. ***H. L. Daulton.*** *Machine Design*, v. 32, Dec. 22, 1960, p. 24-27.

* **Effects of Contextual Cues on Learning From Connected Discourse.** Suggests that the concept of generalization may be useful in predicting learning from connected discourse; but the concept, at least as employed in Gibson's theory, does not alone explain all of the present results. Concludes that Gibson's concept of generalization must be modified, or that additional processes must be identified which, together with generalization will explain the results, or the concept of generalization must be rejected and other processes identified which may handle these results more parsimoniously. ***Slater E. Newman and Eli Saltz.*** *American Journal of Psychology*, v. 73, no. 4, Dec. 1960, p. 587-592.

* **Spatial Localization of After-Images.** This investigation was conducted to establish facts concerning localization of after-images in the third dimension. It was found that after-images of fixation-points in primary objects are seen at the distance of the new point of fixation, and that the size of after-images varies with the distance of this point. ***J. L. Zajqc.*** *American Journal of Psychology*, v. 73, no. 4, Dec. 1960, p. 505-522.

* **The Effect of Muscular Involvement on Sensitivity: Asymmetrical Convergence on the Distribution of Visual Sensitivity.** Reports two experiments which show effects of asymmetrical convergence on the distribution of visual sensitivity for scotopic and photopic conditions of illumination. The results of these experiments also indicate that the change in the distribution of visual sensitivity is paralleled by a reorganization of visual space, viz., displacement of the apparent median plane. ***Joseph H. McFarland, Heinz Werner, and Seymour Wapner.*** *American Journal of Psychology*, v. 73, no. 4, Dec. 1960, p. 523-534.

Planning R/D Centers Around Human Factors. Discusses influence of environmental conditions, such as proper lighting, adequate noise control, and comfortable body temperature on an individual's performance. ***Rex Hurt.*** *Research/Development*, v. 12, Jan. 1961, p. 76 + 10 pages.

The Perception of Movement Persistence in the Ganzfeld. The apparent persistence of seen movement in a homogeneous visual field (Ganzfeld) is described. The task required that the subject observe the movement of a single, black, spherical stimulus in an otherwise empty field and to report when its movement ceased. The time interval between real and apparent cessation of movement was defined as "time delays". The hypothesis advanced states that the apparent speed of the stimulus in the Ganzfeld is dependent upon the square of its real velocity, its duration and its size. This may be expressed as $t = r + (1/av^2)$ where t = time delay, r = reaction time, v = velocity, and a = the constant of inverse proportionality. The data are discussed in terms of "contrast of velocity". The notion here is that a stimulus traveling at high speed and for a relatively long duration produces a more definite perception of velocity than one traveling slowly and observed for a shorter period of time. Therefore, when the former stimulus suddenly is stopped, the resulting contrast of velocity is great and the response to it rapid, whereas when the latter stimulus is similarly stopped, the resulting contrast of velocity is slight and its perception therefore slower. The data were shown to support this hypothesis. ***James W. Miller and Elek Ludvigh.*** *Optical Society of America, Journal*, v. 51, Jan. 1961, p. 57-60.

Eye Location for a Wide-Field Large-Exit-Pupil Optical System. An experiment was performed to determine whether there was a preferred location for the observer's eye in a system

employing both a wide field of view and a large-exit-pupil eyepiece. The special equipment constructed for the experiment is described. A chart is provided which summarizes the results of the study in graphic form. This depicts the eye rotation angles achieved before vignetting occurs for various locations of the eye with respect to the instrument pupil. ***Irving J. Spiro.*** *Optical Society of America, Journal*, v. 51, Jan. 1961, p. 103-104.

Visual Thresholds in the Retinal Periphery for Red, Green, and White Signal Lights. Experiments on the visual threshold in the periphery, including the extreme periphery, are reported. The method of adjustment was used to obtain the threshold for steady white, red, and green signals subtending an angle of 2.6 min at the observer's eye. Results are presented graphically. ***W. E. Knowles Middleton and G. W. Wyszecki.*** *Optical Society of America, Journal*, v. 51, Jan. 1961, p. 54-56.

INFORMATION—PREPARATION AND DISSEMINATION

Edge-Coded Cards. They Analyze Experimental Data. Spotting the significant variables in a mass of experimental data is much easier if you can scan hundreds (or perhaps thousands) of two-variable graphs. With these coded cards, you simply arrange the results in the order you want and the graphs plot themselves. ***F. E. Satterthwaite.*** *Product Engineering*, v. 32, no. 1, Jan. 2, 1961, p. 44-47.

Automatic Language Translation. Lexical and Technical Aspects, With Particular Reference to Russian. Primarily concerned with certain fundamental lexical and technical problems of translation by machine, the author describes available machines and techniques of coding, and discusses the general aims of translation and what can be accomplished by machine. The remaining chapters are devoted to Mr. Oettinger's extensive study of translation from Russian to English, using a Univac I computer. ***Anthony G. Oettinger.*** 380 pp. 1960. Harvard University Press, Cambridge, Mass. (PN242 Oe8a)

Information Retrieval: What Will It Do for the Chemical Engineer? The new information-retrieval techniques will be cooperative ventures of men and machines. In a given field, information retrieval must be integrated with professional activity in that field. For the CPI, this means close coordination with research and development, production and sales planning, and management decisions. ***J. W. Perry.*** *Chemical Engineering*, v. 67, Dec. 26, 1960, p. 89-98.

Systems Engineering. II. Systems Literature. An extensive bibliography of books and journal articles in systems engineering. ***Theodore J. Williams.*** *Chemical Engineering*, v. 67, Dec. 26, 1960, p. 101-106.

Novel Indexing Device Solves Technical Filing Problems. Sight through holes in home-made punched cards—then go directly to all pertinent information in your file drawer. It is a desk-top version of the Peek-a-Boo information-retrieval system developed for libraries containing up to 40,000 documents. ***R. E. Wendt, Jr.*** *Product Engineering*, v. 32, no. 3, Jan. 16, 1961, p. 48-49.

* **Instant Words for Engineers.** Explains the success of a "Word List" of specialized, new, or unusual words of use to engineers writing reports in the atomic energy field. ***John E. Gregory.*** *STWP Review*, v. 8, no. 1, Jan. 1961, p. 21-23.

* **The Technical Editor in Industry.** Gives results of a survey made on the present status of technical editors in various industries. ***B. H. Weil.*** *STWP Review*, v. 8, no. 1, Jan. 1961, p. 4-9.

* **Industrial Communications—The Eve of Maturity.** The feasibility of high-speed, large-capacity electronic communication systems really indicate that industrial communications are on the eve of maturity. ***P. V. G. Wallace.*** *Advanced Management*, v. 25, Dec. 1960, p. 20-23.

Research on Handling Scientific Information. Gives an informative account of the scope of present activities in the field of research on information handling and brief descriptions of current research projects. Emphasis is placed on projects supported by the National Science Foundation. ***Helen L. Brownson.*** *Science*, v. 132, Dec. 30, 1960, p. 1922-1931.

INSTRUMENTATION

* **Measurement of the Widths of Microwave Spectral Lines.** The design of a microwave spectrograph constructed for precise measurements of line widths is described. The effects of microwave power, frequency and amplitude of the source modulation, and klystron mode curvature on the apparent widths of the spectral lines are investigated. It is found that source modulation by square wave yields more accurate data than by sine wave. ***Edgar A. Rinehart, Roger H. Kleen, and Chun C. Lin.*** *Journal of Molecular Spectroscopy*, v. 5, no. 6, Dec. 1960, p. 458-473.

* **Further Modification of Flame Photometer: Dual-Channel Circuit for Convenient Determination of Sodium and Potassium.** Mechanical and electrical modifications of the Baird flame photometer are described that increase ease of setting, improve the precision of response, and permit both Na and K to be determined without resetting zero or sensitivity controls. ***Samuel Raymond.*** *Clinical Chemistry*, v. 6, no. 6, Dec. 1960, p. 598-606.

Thermoelectric Refrigerator of the Line Recorder Mass Spectrometer (Theoretical Design). A theoretical discussion of a thermoelectric device for cooling the line recorder chemical trap is presented. For such a device, semiconductor materials are employed to do the heat pumping. The materials considered are lead telluride (PbTe) and bismuth telluride (Bi_2Te_3). Also included are a brief treatment of semiconductor thermoelectric theory and design calculations for a single-stage and a two-stage refrigerator. At present, a lead telluride unit appears impractical and a bismuth telluride unit appears too costly. A bismuth telluride refrigeration unit should be perfected for other uses. ***P. I. Davis.*** *U. S. Atomic Energy Commission, GAT-365*, Nov. 14, 1960, 24 pp. (UF767 Un3.1ga Contin.)

* **Magnetic Tape Recording.** The tape recorder has become a basic tool for advanced scientific activities, contributing greatly to industrial and military research programs, in missile development, satellite tracking, and in related laboratory procedures. This phase of recording, referred to as "instrumentation recording", concerns itself with measurement, data storage, data analysis, research, and industrial control. ***Paul J. Weber.*** *ISA Journal*, v. 7, Dec. 1960, p. 31-40.

* **Automatic Brightness Pyrometer Uses a Photomultiplier "Eye".** The optical brightness pyrometer has been a recognized stable, temperature-measuring instrument. Now, its inherent limitations have been alleviated by an automatic radiometric pyrometer that still retains all the previous advantages. ***Sumner Ackerman and Joseph S. Lord.*** *ISA Journal*, v. 7, Dec. 1960, p. 48-51.

* **Flame Ionization Analyzer for Hydrocarbon Detection.** Reports on the methods for applying the analyzer to auto exhaust and afterburner testing, and to air analysis and water systems. Discusses various means of sample injection and equipment calibration as well as the adsorbers which can be used profitably. Gives possible applications of the equipment. ***W. B. Innes and A. J. Andreatch.*** *Industrial Water & Wastes*, v. 5, no. 6, Nov.-Dec. 1960, p. 185-191.

Line-Operated Constant Voltage Supplies for Recorders and Potentiometers. Transistors, operated as diodes, may be used as zener diodes to regulate D.C. constant voltage supplies with low current requirements. Use of a constant voltage transformer considerably reduces voltage variations in the load. Voltage adjustments are easily made by using only components found in chemistry laboratories. ***E. B. Thomas and R. J. Nook.*** *Journal of Chemical Education*, v. 37, Dec. 1960, p. 641-642.

A Simple Agitation Device for Several Closed Containers. A simple device employing Teflon coated magnetic stirring bars and an alternating field of magnetic flux has been made. The system accommodates six 250-ml polyethylene bottles. The circuit consisted of a rectifier, choke coils, and a direct current direction alternator. ***James B. Beal, Jr. and Albert W. Jache.*** *Journal of Chemical Education*, v. 37, Dec. 1960, p. 615.

* **The *Ultrotome* Ultramicrotome—Basic Principles and Summarized Description of Construction.** Basic principles of ultramicrotomes and the reasons for choosing the principles employed in the Ultrotome are discussed. A brief description of the practical design of some of the most important constructional elements is given. ***Börje Hellström.*** *Science Tools*, v. 7, no. 2, Aug. 1960, p. 10-16.

* **The Influence of Back-Diffusion on the Sensitivity of Photoelectric Counters.** The influence of the gas atmosphere on counters made of Al was investigated. The effects of sensitivity, as obtained with a high rate of pulses, are excluded. Industrial H was used as a gas at a pressure between 5 and 100 Torr. The counting tubes were exposed to light of wave lengths of 334, 313, and 298 mμ. Back diffusion increases when the gas pressure is higher and the wave length of the incident light is shorter. (*In German.*) Der Einfluss der Rückdiffusion auf die Empfindlichkeit eines Lichtzählrohres. ***K. M. Vahlbruch.*** *Vakuum-Technik*, v. 9, no. 8, Dec. 1960, p. 229-232.

* **Device for High-Precision Time-Resolved Spectroscopy.** In cyclic transient electric dischargers, the selection of time ranges with time resolution in microseconds is accomplished with the aid of a rotating disk. For phasing the disk use is made of the stroboscopic effect produced by the light of the spark on the rotating disk placed before the slit of the spectrograph. Synchronization of the moment of discharge initiation and the rotational phase position of the rotating disk with respect to the slit of the spectrograph is needed. ***Á. Bardóczy.*** *Spectrochimica Acta*, v. 16, no. 10, Nov. 1960, p. 1173-1175 + 1 plate.

Modified Double Slit Interferometer for Shock Wave Investigations. In common with Rayleigh interferometers currently used for diffusion, electrophoresis, and ultracentrifuge studies, the instrument adapted for the present application contained a cylinder lens for bringing the interference fringes and the test section into simultaneous focus at the camera image plane. However, in contrast to previous applications, the light paths through both slits traversed the test section. ***George H. Markstein.*** *Review of Scientific Instruments*, v. 31, Dec. 1960, p. 1291-1296.

Detectors for Microwave Spectrometers. Characteristics of crystal diodes and barretters as functions of microwave power are compared with an ideal detector operating at room temperature. A spectrograph is described which was used to measure a $CFCl_3$ line having a calculated absorption coefficient of 3.9×10^{-11} cm^{-1}. ***Maurice W. Long.*** *Review of Scientific Instruments*, v. 31, Dec. 1960, p. 1286-1289.

Instrument to Measure Fluorescence Lifetimes in the Millimicrosecond Region. Following excitation by a H flash lamp, the fluorescence is observed stroboscopically with a gated photomultiplier. The method of gating is novel and achieves a time resolution comparable with fast oscilloscopes (1.8×10^{-9} sec). ***R. G. Bennett.*** *Review of Scientific Instruments*, v. 31, Dec. 1960, p. 1275-1279.

Design of Mutual Inductance Bridge for Cryogenic Measurements. A bridge may be designed whose components are small and which allows a magnet to be placed around the unknown with no loss in sensitivity and accuracy. ***L. D. Jennings.*** *Review of Scientific Instruments*, v. 31, Dec. 1960, p. 1269-1274.

Modified Coaxial Powder X-Ray Camera. The camera is a modified form of one constructed by L. L. Hawes which employs a flat specimen mounted normal to the direct beam which proceeds along the axis of the cylindrical film. ***D. Jerome Fisher.*** *Review of Scientific Instruments*, v. 31, Dec. 1960, p. 1341-1343.

Simple Apparatus for the Growth of Germanium Dendrites. A description is given of a simple resistance-heated apparatus for pulling Ge dendrites. Two distinct types of growth are obtainable. When the correct conditions are achieved, growth many continue indefinitely. ***Reginald F. Lever, John K. Powers, John L. Richards, and Harry V. Sirgo.*** *Review of Scientific Instruments*, v. 31, Dec. 1960, p. 1334-1335.

High-Temperature Resonant-Cavity Dielectrometer. Can measure dielectric constant and loss-tangent at temperatures encountered by space vehicles re-entering Earth's atmosphere. Technique permits 1% accuracy in dielectric-constant measurements at 2500 F. ***Robert W. Sutton and Nestor Grechny, Jr.*** *Electronics*, v. 34, no. 1, Jan. 6, 1961, p. 118-119.

* **Investigations of Metal Oil Diffusion Pumps in the Ultra High Vacuum Range.** In a vacuum system characterized by two metal oil diffusion pumps in series (Diff 170 and Diff 60) and gold metal joints on the high vacuum side the lgp $- 1/T$ dependence [14] was measured in a temperature range of -40 to $+100$ C after heating the test dome at 400 C for some time. A high-speed gage arrangement is used. The characteristic differences of the used four oils—i.e., mineral oils Apiezon C and Diffoil 71 and silicones as PD75 and DC704—especially at the lower kink of the lgp $- 1/T -$ curve are discussed. (*In German.*) Untersuchungen an Metall-Oeldiffusionspumpen im Utrahochvakuumbereich. ***R. A. Haefer and J. Hengevoss.*** *Vakuum-Technik*, v. 9, no. 8, Dec. 1960, p. 225-229.

* **Flash-Light Sources for Kinetic Spectroscopy in the Far and Vacuum Ultra-Violet.** Flash-light sources suitable for kinetic spectroscopy in the normal and vacuum Ultra Violet are described. These give an almost purely continuous spectrum, with a duration of less than 10 μsec. and have adequate brightness for recording absorption spectra at fairly high resolution. ***B. A. Thrush.*** *Journal of Photographic Science*, v. 8, no. 6, Nov.-Dec. 1960, p. 232-235.

Portable Adhesion Testing Device. Instrument tests on-the-job adhesion of plaster. ***B. M. O'Kelly.*** *ASTM Bulletin*, no. 250, Dec. 1960 p., 32-33.

* **Weaving Trace Optical Gauging Technique.** Allows inspection at high magnification to be carried out on a small compact instrument. Magnification up to 500 times is possible on a screen only 5 in. dia. irrespective of the size of the component. *Metalworking Production*, v. 104, no. 52, Dec. 28, 1960, p. 43-46.

* **A Precision Clock for Measuring Time Intervals.** An electronic clock which uses 10 Mc pulses to measure time intervals is described. The linearity and the average channel width of the system were determined by measuring time intervals between randomly distributed pulses. It was also found, to an accuracy of 0.016%, that the channel width of the time scale was equal to the period of the 10 Mc oscillator. This system is suitable for time interval measurements in a region from 0-15 μsec with a 0.1 μsec resolution. ***R. W. Findley, R. A. Reiter, and T. A. Romanowski.*** *Nuclear Instruments and Methods*, v. 9, Nov. 1960, p. 221-225.

Further Experiences With Aluminium Wire Seals for Bakeable Vacuum Systems. Aluminum wire clamped between stainless-steel flanges and baked at 300 C formed more adherent joints as the surface finish was decreased from 50 to 10 μin. (average height of asperities). The Al joint would not cold weld with a force of 4 tons per inch of 20 s.w.g. wire using flanges with a surface finish of 10 μin., and the flanges were indented by the wire. With constant surface finishes, the strength of the Al joint was directly proportional to the baking temperature above a forming temperature (250 C at 10 μin.) and was greatest when the Al wire was perpendicular to the direction of the machining marks. Seals made between flanges with a 10 μin. finish had an adhesion strength of 354 lb/in. of wire after forming with a force of 5000 lb per in. of wire and baking at 400 C. ***L. Elsworth, L. Holland, and L. Laurenson.*** *Journal of Scientific Instruments*, v. 37, Dec. 1960, p. 449-451.

Portable Water Velocity Meter. Wilkie has described an instrument for measuring the velocity of water, in which the rate of rotation of a small polystyrene rotor is measured by electronic means, using valves as the active circuit elements. This paper describes a circuit in which the valves are replaced by transistors and which is designed so that compensation for changes in the conductivity of the water occurs automatically. As the instrument is small and light and powered by a self-contained battery it is particularly suitable for field work. ***J. M. Edington and L. Molyneux.*** *Journal of Scientific Instruments*, v. 37, Dec. 1960, p. 455-457.

Wide-Angle Photoelectric Integrating Flashmeter. The design, construction, and calibration of a compact portable battery-operated photoelectric integrating photometer, which was developed for measuring very low levels of luminous energy incident on a surface from a distant light flash at night, is described. The instrument has a linear response and on its most sensitive range gives full-scale deflection for an exposure of 0.004 lx s. Drift, arising from the photocell dark current and night-sky background illumination, is neutralized by feeding into the integrating capacitor a variable compensating current. Six ranges of sensitivity are provided, and color filters can be inserted for measurements in restricted wavebands. ***J. Edwards, W. R. Lane, and B. R. D. Stone.*** *Journal of Scientific Instruments*, v. 37, Dec. 1960, p. 452-454.

Photomultiplier Soft X-Ray Spectrometer. Describes a soft X-ray spectrometer which uses a Be-Cu photomultiplier as detector. Unlike most spectrometers of this type it is not a modification of a previously existing photographic instrument, but was designed specifically to take advantage of the new technique. In particular, the photodetector is made to move around the Rowland circle by the simple expedient of mounting it on a radial arm. Its method of use is described and the emission band spectra of Al, Mg, Na, and Li are given as examples of results obtained with it. ***L. Jacob, R. Noble, and H. Yee.*** *Journal of Scientific Instruments*, v. 37, Dec. 1960, p. 460-463.

Viscometers Having Damped Torsional Oscillation. Two types of torsional pendulum viscometers, having only one solid-fluid boundary, have been developed specifically for use in fluidized solids investigations. They may have utility also in coarse or fibrous suspensions or in melts at high temperatures. The theory of these viscometers is discussed and empirical correlations are presented whereby any instrument of these two types may be used with minimal or no calibration. ***B. S. Ashwin, T. Hagyard, I. C. B. Saunders, and T. E. Young.*** *Journal of Scientific Instruments*, v. 37, Dec. 1960, p. 480-485.

Vibrating Reed Magnetometer. This instrument is a development of the pendulum magnetometer for the measurement of saturation magnetization: it has been found especially useful for exploratory work on new materials, since the test samples it requires are small and of simple shape. The specimen is attached to the end of a flat nonmagnetic spring, maintained in continuous vibration in a nonuniform magnetic field: by observing the resonant frequency with and without the field, the magnetization can be calculated by comparison with a reference sample. Accuracies of about 1% can be obtained on materials with specific magnetizations of 50 e.m.u., while the lower limit of usefulness of the instrument is determined primarily by the accuracy required. The device is robust, inexpensive to construct, and, in its present form, may be used from room temperature up to 400 C. ***D. C. Doughty and P. Mossman.*** *Journal of Scientific Instruments*, v. 37, Dec. 1960, p. 471-474.

* **Physical Processes in Small Titanium Ion Pumps.** Experiments with small ion pumps in which Ti is continuously deposited are described. Two types were investigated, the first being a conventional thermionic ionization gage with Ti evaporating from a directly heated source in the envelope and the second a Penning type of discharge tube in which Ti was sputtered from the end plates. In the first type, all the gases and vapors tested were pumped by ion burial and all except Ar were also pumped by adsorption onto the already deposited Ti film and then covered by the arriving Ti. In addition, the hot W could combine chemically with O and also convert H into the atomic form which was then able to diffuse into the Ti. Water vapor and organic vapors were also decomposed by the hot W. In the Penning discharge pump the speed of pumping was constant for each gas over a wide range of pressures, and depended on the Ti sputtering rate and rate of adsorption of the various gases. It was found that appreciable desorption of pumped gases took place in the sputter-ion pump but could be made negligible in the evaporation-ion pump. ***R. O. Jenkins and W. G. Trodden.*** *Vacuum*, v. 10, no. 4, Sept. 1960, p. 319-328.

* **An Experimental 500 KC/S Transistorized Frequency Standard.** The determination of the characteristics of an AT-cut lenticular quartz, excited by a field parallel to its plane, outlines the advantages of this resonator. Values for short-term stability as a function of D.C. supply voltage and ambient temperature

reveal the performance of the maintaining circuit. ***Claude Bernard.*** *Microtecnic* (English Edition), v. 14, no. 5, Oct. 1960, p. 207-213.

Eight-Level Pulse-Height Analyzer for Space Physics Applications. A scintillation spectrometer for the study of low-energy particles in space is discussed herein. The instrument consists of a cesium-iodide scintillation crystal, a photomultiplier with a high-voltage power supply, and a transistorized eight-level pulse-height analyzer of the threshold-integral type. The accuracy of each discriminating level is maintained within ±5% over a temperature range of −10 to +50 C. Since the spectrometer was designed for a spacecraft with digital telemetry, several special features were required in order that the analyzer and telemetry system be compatible. ***U. D. Desai, R. L. Van Allen, and G. Porreca.*** *U. S. National Aeronautics and Space Administration, Technical Note, NASA TN-D-666,* Jan. 1961, 13 pp. (TL570 Un3t Vis.)

* **Rational Arrangement of Transducers for Automatic Control of Horizontal Distribution of Burden.** Optimum location of thermocouples-transducers, used in the system for automatic control of the blast-furnace burden revolving distribution, is given. (*In Russian.*) Ratsional'noe raspolozhenie datchikov avtomaticheskogo upravleniia gorizontal'nym raspredeleniem shikhty. ***P. N. Grekov, V. K. Gruzinov, and B. L. Lazarev.*** *Stal'*, v. 20, no. 11, Nov. 1960, p. 977-980.

* **A Partial Pressure Vacuum Gauge Working According to the Principle of the Electrical Mass Filter.** Theory, description, and operation. (*In German and English.*) ***Karl-Georg Günther.*** *Vacuum*, v. 10, no. 4, Sept. 1960, p. 293-309.

* **Vortex Thermostat.** A thermostat based on the vortex effect of the energy separation of gases is proposed for determining the thermophysical properties of substances. The author points out that the vortex thermostat is reliable in operation, small, and of outstanding simple design. (*In Russian.*) Vikhrevoĭ termostat. ***A. Merkulov.*** *Kholodil'naia Tekhnika*, v. 37, no. 6, Nov.-Dec. 1960, p. 16-18.

LUBRICATION AND FRICTION

* **Design and Application of Externally-Pressurised Air Bearings.** Describes progress made in experimental work on design and applications. ***H. L. Wunsch.*** *Engineering Materials and Design*, v. 3, Dec. 1960, p. 748-753.

A Note on the Influence of Elastic Compliance on Sliding Friction in Ball Bearings. Short discussion on effect of tangential compliance on the friction moment resisting the motion of a ball which is spinning while rolling. ***K. L. Johnson.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 4, Dec. 1960, p. 899-900.

* **Oxidation of Lubricating Greases.** Includes a study of the factors which determine the shapes of oxidation curves and the effects of grease composition, such as soap and base oil type, and acidity or basicity. ***J. E. Goodrich and J. J. Burke.*** *NLGI Spokesman*, v. 24, no. 10, Jan. 1961, p. 397-404.

Your Guide to Roller and Thrust Bearings. Describes 90 distinct roller and thrust bearing configurations. The more common ones are compared on the basis of relative load capacity and speed limitation. ***Nicholas P. Chironis, editor.*** *Product Engineering*, v. 32, no. 3, Jan. 16, 1961, p. 33-43.

The Influence of Speed on Metallic Wear. The rate of wear of brass on hardened steel was measured on a pin-and-ring apparatus over a very wide range of speeds (10^{-2} to 10^{3} cm/s). As speed increases, the rate of wear first decreases to a minimum and then begins to increase again. Radioactive tracer experiments show that over the whole range of speeds the mechanism of wear remains the same; the wear is of the "severe" type in which metallic debris is produced and a film of transferred brass is built up on the steel surface. The decrease in the rate of wear with speed at low speeds is shown to be due to a reduction in the number and in the size of brass fragments transferred to the steel. At high speeds, the number of fragments transferred continues to decrease and the observed increase in the rate of wear arises solely from an increase in the size of the fragments.

This increase is due to softening of the brass by frictional heating and can be prevented by cooling the surfaces. ***W. Hirst and J. K. Lancaster.*** *Royal Society, Proceedings*, v. 259, ser. A, Dec. 6, 1960, p. 228-241 + 5 plates.

MECHANICAL ENGINEERING

* **Criteria for the Use of Steels in High Temperature High Pressure Plants. Safety Materials Employed.** Various formulae for the calculation of tubes and tubing submitted to internal pressure, at room or at high temperature, and in absence or with elevated radial thermal flux, are examined. Considerations on the induced stresses in tubes under restraint and abrupt temperature changes are given. The importance of thermal shock is pointed out and a formula is given for calculation of the maximum tube heating speed. (*In Italian.*) Criteri per l'impiego degli acciai negli impianti ad alta pressione ed alta temperatura. Valori ammissibili per il calcolo, criteri di sicurezza, materiali più impiegati. ***A. Feroci.*** *Metallurgia Italiana*, v. 52, Oct. 1960, p. 661-668.

Correlation of Cavitation Inception Data for a Centrifugal Pump Operating in Water and in Sodium-Potassium Alloy (NaK). The static head at pump suction at the time of cavitation inception was correlated for water and for 1500 F NaK on the basis of the differences of the vapor pressures of the two liquids. The difference between the vapor pressures, for the same conditions of pump speed and liquid flow, was added to the water-test cavitation inception value; this proved to be a good approximation to the experimental value found for cavitation inception with NaK. ***A. G. Grindell.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 4, Dec. 1960, p. 821-828.

Mechanism Design. IV. Inversion. The principle of kinematic inversion and how it can be used to advantage in the synthesis and analysis of mechanisms. ***Thomas P. Goodman.*** *Machine Design*, v. 33, Jan. 5, 1961, p. 126-133.

* **The Dynamic Plane Deformation of an Ideal Plastic-Rigid Solid.** Deals with the motion under plane strain conditions when the inertial forces are not negligible. Shows that the equations for such a motion can be expressed in a simple form. A perturbation method of solving the equations is described. ***A. J. M. Spencer.*** *Journal of the Mechanics and Physics of Solids*, v. 8, no. 4, Nov. 1960, p. 262-279.

* **Determining Machine Foundation Natural Frequencies by Analysis.** Analytic procedures based on Rayleigh's principle are applied to vertical and horizontal vibration. It is shown that the values obtained for the vertical natural frequencies of machine foundations agree very closely to those given in the empirical plot of Tschebotarioff. ***G. Ford and J. B. Haddow.*** *Engineering Journal*, v. 43, Dec. 1960, p. 76-80.

The Chemistry of Materials Failure. A general review of basic factors which underlie and control material failure. Consideration is given to the thermodynamics of material change. ***A. H. Bushey.*** *Materials in Design Engineering*, v. 52, no. 7, Dec. 1960, p. 99-103.

Mechanism Design. III. Rotation. Analytical and graphical techniques for designing link mechanisms that guide a coupler through a desired nonlinear path. ***Thomas P. Goodman.*** *Machine Design*, v. 32, Dec. 22, 1960, p. 110-117.

Ways to Solve Intricate Diecastings. Design methods for adapting the usual casting procedure to special needs based on a set of internal standards from the Bell Telephone Laboratories. *Product Engineering*, v. 32, no. 1, Jan. 2, 1961, p. 36-39.

Safe Tolerance for Cumulative Dimensions. A graph is presented to help interpret what tolerance is practical and acceptable. ***E. R. Wolff.*** *Product Engineering*, v. 32, no. 1, Jan. 2, 1961, p. 40-43.

* **Friction as a Factor in Bolt Tension, Galling, Seizing. I.** Prevention of galling, seizing, and metal pickup by lubrication with pure molybdenum disulfide. ***Harry Gerstung.*** *Assembly & Fastener Engineering*, v. 4, Jan. 1961, p. 32-35.

Spring Mechanisms—Continuous Balancing. Continuous balancing for any number of precision points is possible with odd-shape pulleys. ***Kurt Hain.*** *Product Engineering*, v. 32, no. 3, Jan. 16, 1961, p. 46-47.

* **The Structural Membrane.** The basic theory of funicular shapes and the transformation of these into structural membranes is shown. ***Kolbjorn Saether.*** *American Concrete Institute, Journal*, v. 32; *ACI Proceedings*, v. 57, no. 7, Jan. 1961, p. 827-850.

* **Ultimate Strength of Nonrectangular Structural Concrete Members.** Test data are presented which demonstrate the applicability to nonrectangular structural concrete members of fundamental plasticity concepts deduced from tests of rectangular structural concrete members. ***Alan H. Mattock and Ladislav B. Kriz.*** *American Concrete Institute, Journal*, v. 32; *ACI Proceedings*, v. 57, no. 7, Jan. 1961, p. 737-766.

* **Fracture of Closed Circular Pipes Under Internal Pressure and Axial Tension.** Consideration is given to plastic equilibrium analysis of stress and strain. The surface of strong instability as a boundary for regions of plastic equilibrium and plastic flow is discussed. Concludes with a discussion of the fracture of pipes: determination of fracture and maximum loads before fracture. Tables of equilibrium loads are included. ***Tsuan Wu Ting.*** *Journal of Mathematics and Mechanics*, v. 9, no. 6, Nov. 1960, p. 821-867.

* **Numerical Solution of the Frequency Equations for the Flexural Vibration of Cylindrical Rods.** A numerical solution of Pickett's frequency equations for the flexural vibration of cylindrical rods, based on the three-dimensional differential equations of elasticity, was obtained on the IBM 704 computer. The results are presented in the form of tables of correction factors. These results provide an accurate means of calculating Young's modulus from the density, dimensions, and resonance frequencies of cylindrical rods having diameter-to-length ratios as high as 0.6. ***W. E. Tefft.*** U. S. *National Bureau of Standards, Journal of Research, Section B, Mathematics and Mathematical Physics*, v. 64B, no. 4, Oct.-Dec. 1960, p. 237-242.

Thermal Cycling and Leakage Tests of 2-In. Valves for Sodium Service. Five different valve types, representing eight manufacturers, were sodium-leak tested at pressure differentials of 10 to 30 psi, and temperatures between 395 and 685 F. ***C. J. Baroczy.*** *U. S. Atomic Energy Commission, NAA-SR-5275*, Dec. 1, 1960, 23 pp. (UF767 Un3.1na Contin.)

The Selection, Design Modification, and Analysis of Sodium Valves for Hallam Nuclear Power Facility. Results of the testing of the valves are considered very satisfactory except in the area of across-the-seat leakage of the prototype for the primary throttling valves. ***B. Brooks, R. Galantine, and F. Bergonzoli.*** *U. S. Atomic Energy Commission, NAA-SR-5463*, Dec. 1, 1960, 36 pp. (UF767 Un3.1na Contin.)

* **Rotating Frames of Reference and the Vector Concept.** Investigates the classical expressions for velocity and acceleration associated with two reference frames, one in rotational motion with respect to the other. ***Robert C. Wrede.*** *American Mathematical Monthly*, v. 67, no. 10, Dec. 1960, p. 976-982.

METALLURGY

* **Yttrium, Scandium and the Rare Earths. A Survey of the Status of Investigation. II.** Properties, technology, and technical utilization are discussed. (*In German.*) Yttrium, Scandium und die seltenen Erden—Überblick über den Stand der Forschung. II. ***K. Strnat and H. Weik.*** *Metall*, v. 14, Dec. 1960, p. 1163-1170.

Development of Refractory Metal Sheet in the United States. Extensive programs were conducted on the metallurgy of Mo. More recently a series of programs was initiated on Cb, W, and Ta. Describes the status of the technical development of sheet alloys of these materials from the standpoint of the users and the producers and the refractory metals sheet rolling program. ***R. I. Jaffee, W. J. Harris, Jr., and N. E. Promisel.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 67, Sept. 20, 1960, 12 pp. (TN799 B32.2d Contin.)

a • * **Manufacture, Properties and Application of Semi-Killed Steel.** Purpose of semi-killed steel melting; literature review; test melt procedure and utilization; melting and casting data; results obtained in rolling mill; properties of semi-killed steel; strength properties; segregation behavior; weldability; and application of semi-killed steel. (*In German.*) Herstellung, Eigenschaften und Verwendung von halbberuhigtem Stahl. ***Kurt Fellcht and Hans-Joachim Eckstein.*** *Neue Hütte*, v. 5, Oct. 1960, p. 590-596.

b • * **Gadolinium and Its Alloys.** A study of the physicomechanical properties of 99.0% pure metallic Gd revealed specific density 7.90 determined by the hydrostatic method and 7.85 by the X-ray method, melting temperature 1325 ± 5 C, Brinell hardness 60 kg/mm², tensile strength 21.7 kg/mm², tensile plasticity 20%, and electroconductivity at 20 C 140.10^{-6} ohm.cm. A study was also made of alloying Gd with Fe, Ni, and Mn. (*In Russian.*) Gadolinii i ego splavy. ***E. M. Savitskii, V. F. Terekhova, and I. V. Burov.*** *Tsvetnye Metally*, v. 33, no. 11, Nov. 1960, p. 59-64.

c • **Applications of Radioisotopes in Metallurgical Research.** Describes application of radioisotopes and radioactivity techniques in extractive metallurgy. Includes a discussion of licensing and safety requirements, a general description of the laboratory and the methods used, a definition of the nature and scope of the research program, and a synopsis of the more important problems studied. ***H. L. Gibbs, C. H. Schack, and J. B. Clemmer.*** *U. S. Bureau of Mines Report of Investigations* 5689, 1960, 12 pp. (TN21 Un3r Room 290)

d •

e • ## METALS—CORROSION

f • **The Oxidation of Intermetallic Compounds. III. The Room-Temperature Oxidation of $A^{III}B^{V}$ Compounds.** The oxidation of vacuum-crushed InSb, GaSb, AlSb, InAs, GaAs, and InP has been studied at 26 C, and the kinetics have been analyzed in terms of an empirical function. The results are interpreted in terms of metastable surface complexes whose formation procedes the initiation of true oxide growth. The composition of these intermediates is dictated largely by the nature of the B^{V} atom in the substrate. ***A. J. Rosenberg.*** *Physics and Chemistry of Solids*, v. 14, July 1960, p. 175-180.

g • * **Protection of Perlitic Steel Against High Temperature Gas Corrosion.** The structure of the covering layer does not appear before the thermal treatment. After experimenting at 650 C in vapor and in air media, the structure of the layer consists of a hard solution of P in Ni with inclusions of particles of the excess Ni_3P phase, which when the temperature increases or is maintained for a long time becomes less dispersed. (*In Russian.*) Zashchita perlitnykh staleĭ ot vysokotemperaturnoĭ gazovoĭ korrozii. ***A. V. Riabchenkov and V. I. Velemitsina.*** *Metallovedenie i Termicheskaia Obrabotka Metallov*, 1960, no. 11, Nov., p. 39-42 + 2 plates.

h •

i • * **Thermodynamics of Corrosion in Fused Chlorides.** It is shown that the prime factors which determine how much corrosion can take place in a given system are the nobility of the metal and the stability of the chloride. Also important are the initial redox potential of the melt, the solubility in the melt of the metal produced by the reduction of the chloride, the pressure over the system, the solubility product of the metal oxide, and the presence of impurities, including water—which is considered in some detail. ***C. Edeleanu and R. Littlewood.*** *Electrochimica Acta*, v. 3, no. 3, Oct. 1960, p. 195-207.

j • **Corrosion Problems in the Use of Dense Salt Solutions as Packer Fluids.** The corrosion characteristics were studied of dense salt solutions used as packer fluids during multiple completion of oil and gas wells. Among the salts considered were: $NaNO_3$, $CaCl_2$, $Ca(NO_3)_2$, $ZnCl_2$, $NaNO_3$-$CaCl_2$, $Ca(NO_3)_2$-$CaCl_2$, and $CaCl_2$-$ZnCl_2$. Only slight corrosivities were noted for the first three solutions. However, stress corrosion cracking was encountered in $NaNO_3$ solutions and in some mixtures of $NaNO_3$ and $CaCl_2$. Zinc chloride was too corrosive to obtain useful densities by itself. Both $NaNO_3$-$CaCl_2$ and $Ca(No_3)_2$-$CaCl_2$ exhibited severe pitting at elevated temperatures. ***C. M. Hudgins, J. E. Landers, and W. D. Greathouse.*** *Corrosion*, v. 16, Nov. 1960, p. 91-94.

k •

* **New Investigations About Stabilized and Non-Stabilized Acidproof Austenitic Steels.** The author studied the effects of different components, especially O_2 and oxides, on austenitic Cr-Ni steels, applying the Huey test for intergranular corrosion, and testing the stress corrosion cracking in boiling 42% magnesium chloride solution. Crack-resistance is increased in these steels by increasing C and Si contents. Decreasing the O_2 or oxide contents had no effects on the crack resistance. (*In German.*) Neue Untersuchungen über stabilisierte und nicht stabilisierte, säurebeständige, austenitische Stähle. ***Herbert Krainer.*** *Berg-und Hüttermännische Monatshefte der Montanistischen Hochschule in Leoben,* v. 105, no. 11, Nov. 1960, p. 280-291.

a

Selective Corrosion of Inconel. Inconel sheet, rod and tube samples were tested in the as-recieved condition by complete immersion in a fused salt bath. Tests were carried out at 800 C for test times up to 50 days. It was found that a layer of porous sponge-like material formed on the surface. Cr and Fe were preferentially leached out of these layers. ***R. Bakish and F. Kern.*** *Corrosion,* v. 16, Nov. 1960, p. 89-90.

b

Stress Corrosion Cracking of Carbon Steels in Concentrated Sodium Nitrate Solutions. Results for different steels under different conditions are discussed. The susceptibility of carbon steel seamless tubes to cracking in $NaNO_3$ is much greater when stressed in the transverse direction than when stressed longitudinally. ***R. L. McGlasson, W. D. Greathouse, and C. M. Hudgins.*** *Corrosion,* v. 16, Nov. 1960, p. 113-118.

c

Cracking of Low Carbon Steel by Ferric Chloride Solutions. Aqueous corrosion of mild steel at 316 C is greatly accelerated by low concentrations of $FeCl_3$. This can lead to stress corrosion cracking in plastically deformed areas subject to high stress. Analogous results can be obtained with chloride-bearing slurries of the ferric oxides and hydrated oxides γ-FeOOH, α-FeOOH, γ-Fe_2O_3, and αFe_2O_3 or from slurries of these compounds in contact with chloride-bearing solutions. ***Mary Boehm Strauss and M. C. Bloom.*** *Corrosion,* v. 16, Nov. 1960, p. 109-112.

d

New Developments in the Mitigation of Corrosion in the Utility Field. The use of distributed high silicon iron anodes for corrosion protection of an underground lead-covered cable distribution system is discussed. Electrolytic zinc cells for use on pipe-type cables and for control of induced voltages on pipelines also are considered. The use of well-type ground beds for cathodic protection of buried metallic structures at generating stations is described, and methods of protection of silicon rectifiers from damage because of surges are explained. The use of concrete as a coating on steel structures in shielded areas of cathodically protected complex systems is described. Other topics discussed include condenser water-box corrosion and dangers from stray current discharges. ***E. H. Thalmann.*** *Corrosion,* v. 16, Nov. 1960, p. 99-108.

e

Stress-Corrosion Cracking of High Strength Oil Country Tubular Goods. Catastrophic failures of oil country tubular goods caused by stress-corrosion cracking have been steadily increasing. Failure experience with N-80, 9% Ni, 9% Cr, and AISI 4340 tubing and N-80 casing is enumerated and the failure significance discussed. The status of the problem is discussed with respect to the corrosion mitigative measures currently available. ***R. S. Ladley.*** *Corrosion,* v. 16, Nov. 1960, p. 93-98.

f

Marker Movements in the Oxidation of Iron and Some Other Metals. Experiments carried out on Fe and some nonferrous metals have shown that Pt wire markers can be moved inwards with the metal interface or outwards with the oxide/air interface according to the diffusion mechanism, film plasticity, and the adherence of the film to the metal substrate. ***R. F. Tylecote and T. E. Mitchell.*** *Iron and Steel Institute, Journal,* v. 196, pt. 4, Dec. 1960, p. 445-453.

g

An X-Ray High-Temperature Oxidation Study on Iron-Copper. The results show the types and proportions of pure metal and oxide phases during oxidation as a function of time and temperature up to 1000 C at a low air pressure. A major feature is a radical change in oxide constitution on passing the A_3 point in Fe, accompanied by the reappearance of the metal phases. ***H. J. Goldschmidt.*** *Iron and Steel Institute, Journal,* v. 196, pt. 4, Dec. 1960, p. 390-393.

h

* **Factors Influencing the Electric Soil Resistance and Its Anticorrosion Value.** The author studied the dependency of the results of soil resistance measurements on the type of soil, its structure and electrolyte content, as well as on the soil moisture and temperature. The results were discussed and indications were given concerning the practical range of resistance measurements and of some complementary chemical investigations. (*In German.*) Einflussgrössen auf den elektrischen Bodenwiderstand und seine Bedeutung für den Korrosionsschutz. ***Walter von Baeckmann.*** *GWF; Gas- und Wasserfach* (Gas), v. 101, no. 49, Dec. 2, 1960, p. 1265-1273.

i

* **Report on the Decomposition of Anode-Produced Valve Oxide Layers on Tantalum.** It was found that the formation of the layer, especially in an acidic electrolyte, results in a stable form. The after-treatment of a layer in boiling water causes a small delay of the extractions. The treatment in superheated water vapor considerably delays the separation. (*In German.*) Beitrag zum Abbau anodisch erzeugter Ventiloxydschichten auf Tantal. ***G. Hahn.*** *Metall,* v. 14, Dec. 1960, p. 1171-1174.

j

* **Inhibition of Aluminium-Zinc Alloy Corrosion in Sodium Hydroxide.** The corrosion rates for aircraft aluminum-zinc alloy were determined in sodium hydroxide solutions. The inhibitor efficiency decreases for the inhibitors in the order: gum acaciae, agar agar, gelatin, dextrin and glue. Polarization studies with dextrin show that cathode polarization is negligible, whereas anode polarization is appreciable and is significantly increased by inhibitor. The corrosion process appears to be under mixed control with predominance of action of dextrin inhibitor on the anodic areas of the metal surface. ***J. Sundararajan and T. L. Rama Char.*** *Corrosion Prevention & Control,* v. 7, Dec. 1960, p. 38-39.

k

* **Materials of Construction for Chemical Plant. Timber.** General description of the use of timber in chemical processing industries including a tabulation of recommended timbers for various plant conditions. ***V. R. Gray.*** *Chemical & Process Engineering,* v. 41, Dec. 1960, p. 557-561.

Slimicide With New Twist. The first new slimicide to get the Food & Drug Administration's approval for use since enactment of the Food Additives Amendment in Sept. 1958 is now being marketed under the tradename Silicide. The product is based on a familiar material, silver fluoride. The fluoride has been irradiated by ultraviolet light, has almost double its normal microbe killing power. Silicide does not lead to the development of immune strains of slime agents, does not decompose as it kills off microbes, and has no electrolytic action that might lead to problems of corrosion in equipment. *Chemical Week,* v. 88, no. 2, Jan. 14, 1961, p. 52.

Inhibition of Corrosion of Commercial Aluminum in Alkaline Solutions. The corrosion rates for commercial Al, containing 4% Mn and 3% Fe, were determined in sodium hydroxide solutions under different conditions. The inhibitor efficiencies were calculated for the following substances, the efficiency decreasing from 90 to 60% in the order: agar-agar, gum-acaciae, dextrin, gelatin, glue. Corrosion potentials were measured with and without dextrin inhibitor, and cathodic and anodic polarization studies made. The results show that the dissolution of the metal is electrochemical in character. The corrosion process appears to be under mixed control with predominance of action of dextrin inhibitor on the anodic area of the metal surface. ***J. Sundararajan and T. L. Rama Char.*** *Corrosion,* v. 17, Jan. 1961, p. 111-116.

* **Change of the pH Value in a Solution During the Corrosion of Carbon Steel in Sea Water.** Due to the deposition of $CaCO_3$ and $Mg(OH)_2$, the simultaneous effects of the anodic and cathodic processes cause a decrease of the pH approximately to 4. This value is determined by the corrosion current density and the relationship between the volume of the solution and the surface of the metal. On the anodic sections of the macrocells in the stagnant zones, the pH value decreased to 3.3-3.4. (*In Russian.*) Izmenenie velichiny pH rastvora pri korrozii uglerodistykh staleĭ v morskoĭ vode. ***I. B. Ulanovskiĭ.*** *Zhurnal Prikladnoĭ Khimii,* v. 33, no. 11, Nov. 1960, p. 2557-2562.

A Comparison of the Corrosiveness of Indoor Atmospheres. The exposure of sets of small test specimens in 45 different atmospheres, principally indoors in factories, has pro-

vided a measure of the relative corrosivness of the atmospheres in such places. The test specimens were of bare low-alloy, mild steels, and mild-steel sprayed with Al or with Zn. The most corrosive indoor atmospheres investigated were those where large quantities of acids were used, and those of a bleach-house, a plating shop and a glue extraction plant. Several were more corrosive than the atmosphere outdoors at Sheffield, particularly towards the metal coatings. Although Al protected the steel better than did Zn when freely exposed outdoors in industrial atmospheres, a Zn coating was much superior to an Al one in many of the indoor atmospheres. High humidity was associated with rapid corrosion rates but corrosion was slow in relatively clean but humid atmospheres, such as were found in a laundry, domestic kitchens and bathrooms. ***J. F. Stanners.*** *Journal of Applied Chemistry*, v. 10, pt. 2, Nov. 1960, p. 461-470.

* **Stainless Steel Ups Condenser Tube Life 300%.** Longer life, better performance, improved heat rate, less corrosion and easier installation and cleaning are advantages of stainless steel condenser tubes proved by utility's experience with highly corrosive river water. ***Ernest R. Long.*** *Electric Light and Power*, v. 39, no. 2, Jan. 15, 1961, p. 54-57.

Thunderbird Gets Stainless Muffler. A new modification of AISI 410 stainless steel, MF-1, containing 11% Cr, 0.36% Ti, and costing about a third less than the conventional grade has been developed for use in critical inner parts of certain 1961 automobile mufflers. Lifetimes 2+ times that of aluminized steel and 5+ times that of carbon steel are reported upon exposure to accelerated corrosion tests with liquid exhaust condensates. *Steel*, v. 148, Jan. 16, 1961, p. 51-52.

Field Ionization and Field Ion Microscopy. The uses of the techniques of field ion microscopy in fundamental stuides of adsorption and corrosion phenomena as well as in metallurgical research basic to corrosion such as studies of vacancies, interstitials, dislocations, impurities, slip, cold working, strain release, fatigue radiation damage, and field-induced chemical reactions are described. ***Erwin W. Muller.*** Paper from "Advances in Electronics and Electron Physics", v. XIII, p. 154-177, 1960. Academic Press, New York. (TK161 A953 Vis.)

Some Observations on the Stress-Corrosion Cracking of α-Brass and Similar Alloys. An attempt was made to establish a mechanism for stress corrosion by direct observation on the propagation of cracks in α-brass tested under ammonia. The observations indicate that failure might be described by a two-stage process, of local embrittlement followed by a cleavage-like fracture. Such a model demands that the embrittled zone should have its mechanical properties modified in such a way as to allow a crack to form and reach some critical velocity, while the normal unattacked metal should be able to support this free-running crack for extensive failure to occur. These requirements are examined in the light of current ideas on the metal physics of fracture. ***C. Edeleanu and A. J. Forty.*** *Philosophical Magazine*, v. 5, ser. 8, Oct. 1960, p. 1029-1040.

High Temperature Oxidation of Iron-Chromium Binary Alloys in Water Vapor. I. A Preliminary Study of the Mechanism of Oxidation of Iron-Chromium Binary Alloys in Water Vapor. The oxidation of a series of iron-chromium binary alloys in a water vapor-argon atmosphere at high temperatures was investigated. The chromium contents of the alloys were 5, 10, 15, 20, and 25% and the oxidation temperatures were 700, 900, and 1100 C. Powder X-ray diffraction methods and metallographic techniques were used to identify the oxides that were present in the scales formed on the alloy. Generally, the scales that formed on each specimen could be conveniently divided into three parts. There is an outer layer of wüstite, a two-phase inner layer composed of wüstite and a mixed Fe-Cr oxide, and a subscale. Correlations between Cr concentration of the alloy, temperature of oxidation, weight gain, oxide composition, and the microstructure of the oxide layers are presented. Weight gain versus time plots indicate that at 700 and 900 C the oxidation follows a parabolic curve, whereas the rate at 1100 C is linear. A possible mechanism of the oxidation process is suggested in the form of wüstite decomposition at the outer-inner scale layer boundary, giving rise to Fe^{+2} diffusion to the outer layer and O^{-2} diffusion to the alloy-oxide interface. ***C. T. Fujii and R. A. Meussner.*** *U. S. Office of Naval Research, NRL Report* 5506, Sept. 21, 1960, 24 pp. (T21 Un3.5n Contin.)

a • * **Corrosion of Iron in the Presence of Hydrogen Sulfide in a Two Phase Electrolyte-Hydrocarbon System.** A sharp increase of the corrosion rate of Fe or of low-carbon steel in the presence of H_2S is caused not only by the hydrogen sulfide dissolved in the electrolyte, but also by the stimulating influence of iron sulfide. This was applied to the study of corrosion inside oil pipelines. (*In Russian.*) Korroziia zheleza v prisutstvii serovodoroda v dvukhfaznoĭ sisteme elektrolit-uglevodorod. ***A. A. Gonik.*** *Akademiia Nauk SSSR, Doklady*, v. 135, no. 2, Nov. 1960, p. 381-384.

b • **In-Pile Corrosion Test Loops for Aqueous Homogeneous Reactor Solutions.** An in-pile corrosion test loop is described which is used to study the effect of reactor radiation on the corrosion of materials of construction and the chemical stability of fuel solutions of interest to the Aqueous Homogeneous Reactor Program at ORNL. Aqueous solutions of uranyl sulfate are circulated in the loop by means of a 5-gpm canned-rotor pump, and the pump loop is designed for operation at temperatures to 300 C and pressures to 2000 psia while exposed to reactor radiation in beam-hole facilities of the LITR and ORR. Operation of the first loop in-pile was begun in Oct. 1954, and since that time 17 other in-pile loop experiments have been completed. Design criteria of the pump loop and its associated auxiliary equipment and instrumentation are described. In-pile operating procedures, safety features, and operating experience are presented. A cost summary of the design, fabrication, and installation of the loop and experimental facilities is also included. ***H. C. Savage, G. H. Jenks, and E. G. Bohlmann.*** *U. S. Atomic Energy Commission, ORNL*-2977, Dec. 21, 1960, 68 pp. (UF767 U3o Contin.)

c • **Studies of Corrosion by Molten Zinc and Cadmium Systems.** A corrosion program was undertaken in conjunction with development of pyrometallurgical processes employing liquid metal solvents as processing media. The metal solvents under consideration for use as solvents for U, Pu, and Th were Zn, Cd, and Mg, either alone or in various combinations with each other. The results are discussed. ***John P. DeKany, Henry W. Lavendel, and Leslie Burris, Jr.*** *U. S. Atomic Energy Commission, ANL*-6243, Oct. 1960, 44 pp. (UF767 Un3.1an Contin.)

d • **Effect of Sodium Exposure on the Mechanical Properties of Zirconium.** It was found that surface oxide which developed on Zr in impure sodium significantly lowered the fatigue life at elevated temperatures. Hydrogen absorption, on the other hand, had little effect on the fatigue life at elevated temperatures but lowered the fatigue life at room temperature. Also, critical recrystallization which occurred above 950 F in Zr (a phenomenon unrelated to the presence of Na) reduced the fatigue life at elevated as well as low temperatures. The effects attributable to Na (i.e., the formation of surface oxide and absorption of reasonable amounts of H), did not significantly alter the tensile properties of Zr at high temperatures. ***J. C. Bokros.*** *Corrosion*, v. 17, Jan. 1961, p. 103-106.

e • * **Conditions for the Cathodic Protection of Metals.** The place of cathodic protection among the accepted techniques for protecting metals against corrosion is first considered. Then the thermal and kinetic factors in cathodic protection are investigated in more detail. Diagrams are given for 43 metals and metalloids, showing in terms of electrode potential and pH, at 25 C, the theoretical factors affecting corrosion, passivation, and immunity (or cathodic protection) of these metals and metalloids. The theoretical conditions are also shown for cathodic protection of Ag, Cu, Pb, Fe, Sn, and Zn with particular emphasis on the possible influence of the formation of solid or gaseous hydrides on protective efficiency. Some examples are given of the use of polarization curves for studying conditions affecting the cathodic protection of ordinary and stainless steel. Particular consideration is given to the case where cathodic "protection" badly carried out may lead to unfavorable results. Finally, the efficiency and reliability of cathodic protection, together with possible developments, are considered. ***M. Pourbaix.*** *Corrosion Prevention & Control*, v. 7, Dec. 1960, p. 43-48.

f • **Techniques and Economics of Combined Cathodic Protection and Cleaning for Heat Exchangers.** Describes use of

cathodic protection and cathodic cleaning of heat exchange equipment. Explains how cathodic protection system was used to supplement water treatment. Data given show 20 condensers were protected by anodes at $800 per year. Cleaning and repair costs for the condensers had been $2000 per year—a saving of $1200 in labor costs alone. Also shows that cathodic cleaning of boilers costs only $60 per boiler. Estimated chemical cleaning cost per boiler was $1500—a saving of $1440 per boiler. ***M. J. Olive.*** *Corrosion,* v. 17, Jan. 1961, p. 9-11.

Laboratory Investigation of Current Distribution on Brass Tube Plates and Tube Ends of Condensers Using Sea Water. Static and dynamic experiments were made on brass tube plates and tube ends of condensers to determine the current distribution on them in sea water. Factors evaluated in this connection include effect of water velocity, effect of coatings, effect of temperature, and effect of composition of the anode and tube materials. It was found that most of the galvanic current flowing from ferrous components (or a steel anode) to a nonferrous condenser tube sheet flowed to the tubes with only a small proportion going to the tube plate. A zinc alloy anode provided a much higher current than a steel anode to both an Admiralty brass tube and an aluminum brass tube. ***P. G. Attwood and W. G. Richards.*** *Corrosion,* v. 17, Jan. 1961, p. 80-82.

Corrosion-Erosion of Sensitized AISI Type 304 Stainless Steel in a Thorium Dioxide-Uranium Trioxide Slurry. Corrosion test loops were employed in evaluating the corrosion-erosion of sensitized AISI Type 304 stainless steel in a thorium dioxide-uranium trioxide slurry. It was found that sensitized, non-pickled Type 304 stainless steel was not attacked intergranularly and exhibited about the same corrosion rate as as-received Type 304. Type 304 stainless steel, sensitized and pickled, was attacked at appreciably higher rates, than as-received Type 304 or than sensitized, non-pickled Type 304; however, when a layer of metal which had been corroded intergranularly by the pickling solution was removed by the action of the slurry, the attack by the slurry diminished. ***D. C. Vreeland.*** *Corrosion,* v. 17, Jan. 1961, p. 93-96.

Corrosion Studies of Aluminum in Chemical Process Operations. Several developments are presented which describe the evolution of laboratory studies into commercial applications for aluminum alloys in the chemical and petroleum industries. Particular attention is given to the study of aluminum alloys for handling 83% ammonium nitrate solutions at elevated temperature. Based on laboratory results, operating procedures have been established for the storage and handling of 83% ammonium nitrate. The discussion also includes applications of Al in the production and handling of aliphatic acids, sour crude oil, amines, hydrogen peroxide, fuming nitric acid, liquids at cryogenic temperatures, and high-purity water. ***E. H. Cook, Jr., R. L. Horst, and W. W. Binger.*** *Corrosion,* v. 17, Jan. 1961, p. 97-102.

* **Internal Carburization and Oxidation of Nickel-Chromium Alloys in Carbon Monoxide Type Atmospheres.** The rate of internal carburization and oxidation of nickel-chromium alloys attains a maximum at 1500-1750 F. Attack was slight at 1330 and 1830 F. The presence of carbon dioxide, water vapor and hydrogen in the carbon monoxide did not significantly affect the rate of penetration. ***B. E. Hopkinson and H. R. Copson.*** *Corrosion,* v. 16, Dec. 1960, p. 100-104.

* **High Temperature Corrosion in Refinery and Petrochemical Service.** Deals with the corrosion phenomena likely to influence the selection of materials for refinery service at elevated temperatures. The problems of oxidation, sulfidation and carburization are discussed in detail and consideration is given to the effects of condensate and residual oil ash corrosion. ***E. N. Skinner, J. F. Mason, and J. J. Moran.*** *Corrosion,* v. 16, Dec. 1960, p. 85-92.

* **Impressed Current Anodes for Cathodic Protection.** Development and use of impressed current anodes for cathodic protection of underground structures is traced from early beginning to present time. Data for calculating anode resistance of earth is presented. Recommendations are made for installing anodes in various soil conditions. ***Walter P. Noser.*** *Corrosion,* v. 16, Dec. 1960, p. 79-84.

METALS—EXTRACTION AND REFINING

a • * **Refining of Light Alloys by Filtering.** Through the application of mechanical filtering with under-pressure in an overflow ladle, a degassing and partial removal of stable non-metallic inclusions was obtained. It was expressed by increased strength properties and decreased porosity of the investigated alloys. An increase in the refining effects was obtained by filtering in the D. C. electric field. (*In Polish.*) Rafinowanie stopów lekkich przez filtrowanie. ***Andrzej Bydałek.*** *Przegląd Odlewnictwa,* v. 10, no. 11, Nov. 1960, p. 317-320.

b • * **Zone Refining With Arc.** Even with spectrographic analysis, a W content in the refined material was not found, i.e., under the sensitivity limit of the method the charge is not contaminated by W from the electrode. Consequently, the method appears to be useful also for refining reactive metals with a high melting point. (*In Czech.*) Pásmová rafinace obloukem. ***Josef Zbořil.*** *Hutnické Listy,* v. 15, no. 11, Nov. 1960, p. 861-864.

c • * **Graphite Electrodes.** Properties of electrodes currently used in arc furnaces. The electrodes are subjected to sublimation, absorption, dissolution, oxidation, and fracture tests. Precautions to be taken in the installation of the electrodes. (*In French.*) Les électordes de graphite. ***C. Theillet.*** *Revue de Métallurgie,* v. 57, Oct. 1960, p. 881-884.

d • * **Pneumo-Hydraulic Control System for the Distribution of Blast in Blast Furnaces.** A pneumo-hydraulic control system on a blast furnace distributes by means of adjustable throttle valves the total inflowing wind uniformly among all tuyeres. Basically, the system consists of a main regulator for adjusting the pressure in the bustle pipe and a positioner for each tuyere; the latter controls the position of the throttle valve. (*In German.*) Pneumo-hydraulisches Regelsystem für die Windverteilung an Hochöfen. ***Wilhelm A. Jaenike.*** *VDI Zeitschrift,* v. 102, no. 34, Dec. 1, 1960, p. 1683-1684.

e • *** Application of the L.D. (Oxygen to Blowing) Process to Irons Rich in Phosphorus. The Technique Used at the Pompey Steelworks.** The process is carried out in two stages with the first deslagging at 20-25% P_2O_5. The final slag is recuperated; this represents an economic advantage. Lime is added in pieces. Cooling takes place by addition of ore (first stage) and scrap iron (second stage). The steel produced with low S and N_2 is equivalent to the corresponding open-hearth steel. (*In French.*) Application du procédé L.D. aux fontes riches en phosphore. Technique utilisée aux aciéries de pompey. ***G. Messin.*** *Revue de Métallurgie,* v. 57, Oct. 1960, p. 947-954.

f • * **A Contribution to the Problem of Improving Lead Blast Furnace Smelting.** A short preliminary orientation study leading to the smelting of high-lead and zinc agglomerates by methodically increasing the Pb contents with corresponding change of the other components. (*In Russian.*) K voprosu uluchsheniia shakhtnoĭ svintsovoĭ plavki. ***I. V. Paramonov.*** *Tsvetnye Metally,* v. 33, no. 11, Nov. 1960, p. 27-32.

g • **The Kinetics of Sulphur Transfer From Iron to Slag.** The transfer rate of S from C saturated iron to a range of CaO-MgO-SiO_2-Al_2O_3-CaF_2 slags was investigated on a laboratory scale at temperatures between 1400 and 1600 C. Analysis of results shows that S transfer is a thermally activated process. The addition of CaF_2 results in an increase in the transfer rate. ***R. G. Ward and K. A. Salmon.*** *Iron and Steel Institute, Journal,* v. 196, pt. 4, Dec. 1960, p. 393-403.

h • * **Improvement of Antifriction Bearing Steel Quality by Electro-Slag-Remelting.** Thirty-two test melts, and especially the properties of the remelted steel CSN 14104, are evaluated. The surface of ingots made by the electro-slag-process are their macrostructure were without defects, the steel was fine-grained, homogeneous, and compact. The S content decreased. The quantity of sulfide inclusions, in some cases also of oxide inclusions, decreased. (*In Czech.*) Zlepšení jakosti oceli pro valivá ložiska elektrostruskovým přetavováním. ***Ivo Petrman and Ivan Kašík.*** *Hutnické Listy,* v. 15, no. 11, Nov. 1960, p. 839-851.

i • **Lining and Operation of Hot-Metal Mixers.** A description of current practice with hot-metal mixers at Völklingen. Gives details of methods of lining, expansion joints, life of mixer-

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k

linings, heating-schedules, etc. ***A. Latour.*** *British Ceramic Society, Transactions,* v. 59, Oct. 1960, p. 432-454.

* **The Effect of Carbonates of Alkali and Alkali Earth Metals on the Reduction of Iron Oxide by Graphite.** The salts of alkali metals have an accelerating effect on the reduction of iron oxide graphite; this effect is increased by the passage of lighter metals to heavier ones. The accelerating effect is connected with the influence of ions of the one-valency alkali metals on the electron composition of the crystalline lattice of the oxide. The salts of bivalent alkali earth metals ($SrCO_3$) accelerate the reduction of Wüstite into metal. (*In Russian.*) Vliianie uglekislykh soleĭ shchelochnykh i shchelochnozemel'nykh metallov na vosstanovlenie okislov zheleza grafitom. ***M. G. Zhuravleva, G. I. Chufarov, and L. G. Khromykh.*** *Akademiia Nauk SSSR, Doklady,* v. 135, no. 2, Nov. 1960, p. 385-388.

* **Arsenic and Phosphorus in High-Alloy Chromium and Chromium-Nickel Steels.** Determines the maximum As or P content without harmful influence in tested steels. The results form an important basis for the possibility of economical scrap utilization and for the choice of basic raw materials when making these steels. (*In Czech.*) Arsen a fosfor ve vysokolegovaných chromových a chromniklových ocelích. ***František Beneš and Dagmar Tlustá.*** *Hutnické Listy,* v. 15, no. 12, Dec. 1960, p. 929-936.

Physical Properties and Constitution of Liquid Slags. Reviews the physical properties of simple slag systems, paying particular attention to the more recent findings in this field of metallurgical research. Electrical conductivity, transport number, viscosity, surface tension, and density measurements are discussed. ***B. T. Bradbury and D. J. Williams.*** *Metallurgia,* v. 62, Dec. 1960, p. 235-240.

* **Investigations of the Lead-Tin-Oxygen System and Contribution to the Study of the Behavior of Tin During Dry Lead Refining.** The formation of a compound in the solid phase was studied by means of the X-rays and begins partly at 800 C. The removal of Sn is not linked with stannate formation. This formation has no effect on the rate and kinetics of refining. The speed of oxidation of Sn exhibits no maximum, but three distinct areas depending on the Sn content. (*In German.*) Untersuchungen zum System Blei-Zinn-Sauerstoff und Beitrag zum Verhalten des Zinns bei der trockenen Bleiraffination. ***Hans-Friedrich Hadamovsky.*** *Zeitschrift für Erzbergbau und Metallhüttenwesen,* v. 13, Dec. 1960, p. 582-592.

METALS—FINISHING, POLISHING AND CLEANING

* **Scouring Steel Bars and Steel Wires.** A study of the scouring quality and appearance of the semi-products after scouring, of methods using salt in fusion, a soda or a sodium hydride, or an acid in solution in water, such as sulfuric, hydrochloric or phosphoric acids. The safety of the different processes used was examined. (*In French.*) Le décapage des barres et fils d'acier. ***Müller.*** *Chaleur & Industrie,* 1960, no. 425, Dec. 1960, p. 334-342.

Vibratory Finishing. Hows and whys which may mean lower costs and faster production. Examples are given. *Precision Metal Molding,* v. 19, Jan. 1961, p. 54-55.

* **Barrel Finishing in the U.S.A.** Describes factory specializing in the barrel deburring and polishing of customers' products. *Product Finishing,* v. 14, Jan. 1961, p. 94-96.

* **Satin Finishes on Automatic Polishing Machines.** Use of water-based liquid polishing compositions. ***F. W. Anderson.*** *Metal Finishing Journal,* v. 6, no. 72, Dec. 1960, p. 475-476.

The Need for Research on Abraded and Polished Surfaces. A necessary prelude to the solution of many practical problems concerned with the behavior of abraded and polished metal surfaces is a better understanding of the nature of these surfaces. Attention is drawn to a number of topics which appear to be particularly in need of study. ***L. E. Samuels.*** *Plating,* v. 48, Jan. 1961, p. 46-49.

METALS—FOUNDRY PRACTICE

a * **Degassing Molten Steel in Vacuum and Selection of the Most Appropriate Degassing Method.** The degassing of steel was studied by the portion method, and the rotation method, in
• the casting ladle, in the vacuum chamber, when pouring from a ladle under atmospheric conditions into another ladle in vacuum, and during casting from a ladle remaining under atmospheric pressure into a mold in a vacuum chamber. (*In*
b *Polish.*) Odgazowanie ciekej stali w próżni i wybór najwłaściwszego sposobu odgazowania. ***Kazimierz Radźwicki.*** *Wiadomosci Hutnicze,* v. 16, Nov. 1960, p. 342-345.

• **Shrinkage Defects in Iron Castings.** Influence of sodium silicate bonded molds and of oxygen. ***J. H. Gittus.*** *Iron & Steel,* v. 33, no. 13, Dec. 1960, p. 584-586.

c **Flow of Metal Through Screens.** Studies techniques for "straining-off" injurious materials to prevent casting faults. ***J. J. Birch and G. Llewelyn.*** *Foundry Trade Journal,* v. 109, Nov. 24, 1960, p. 659-666.

• **Foundry Experience of the Pinhole Defect in Cast Iron.** The defect is always associated with the presence of traces of Al which increase the tendency of an iron to pick up H from
d a sand mold. Variations in foundry practice will either stimulate or suppress this tendency but no standard plan can be laid down for tracing the immediate cause of outbreaks of pinholing which are generally intermittent and of short duration.
• Results of laboratory tests are briefly reviewed, and the important points found in field investigations are illustrated in the form of hypothetical case histories. Recommendations are made on the best lines to follow in investigating and curing an out-
e break of pinholing. ***J. V. Dawson.*** *B.C.I.R.A. Journal,* v. 8, no. 6, Nov. 1960, p. 805-811.

• **Cupola Spout Temperature Measurement.** Describes immersion thermocouple technique and compares it with that used for temperature measurement by a recently-introduced radiation
f pyrometer which incorporates a barrier layer photocell. ***R. Rew.*** *B.C.I.R.A. Journal,* v. 8, no. 6, Nov. 1960, p. 821-824.

Influence of Grain Size and Stripping Time on the Incidence of Hot Tearing in White Iron Castings. The in-
• fluences of grain size and stripping time were investigated using restrained bar test castings in green sand and dry sand molds. A 30% Cr iron was chosen so that the grain size could be con-
g trolled. The incidence and severity of hot tearing diminished as the grain size decreased, and as little as 0.02% Ti achieved a considerable effect. Larger additions of Ti had progressively less effect on grain size but still further reduced the tendency to hot tearing. For the tests on stripping time an unalloyed
• white iron was used. The severity of hot tearing decreased the longer the casting was left in the mold after pouring and those castings which were stripped before eutectic solidification was complete were particularly susceptible to hot tearing. ***M. D.***
h ***Twitty.*** *B.C.I.R.A. Journal,* v. 8, no. 6, Nov. 1960, p. 844-856.

The Design and Operation of the Cold Blast Acid-Lined Cupola. The general principles of cupola design and operation
• are outlined and special emphasis is placed on those aspects which often receive insufficient attention. Cupola dimensions and linings, and the requirements of blowing equipment, are considered. Recommendations are made in which the importance
i of adequate blower capacity is stressed. Practical aspects of cupola operation affecting melting rate, metal temperature and metal quality are reviewed with particular reference to prepara-
• tion of the coke bed, weighing of metal and coke charges, size of materials and continuity of melting. Brief reference is also made to changes in metal composition during melting, slagging methods, repairs to linings and instruments. ***H. J. Leyshon***
j ***and F. Dunn.*** *B.C.I.R.A. Journal,* v. 8, no. 6, Nov. 1960, p. 825-837.

• **Sand The Molding Tool.** Each ferrous and nonferrous metal requires different molding sand. The author discusses types of sand for each metal and explains how to prepare them. ***W. P. Winter.*** *Foundry,* v. 89, Jan. 1961, p. 108 + 3 pages.

k **Casting Technology for Titanium, Zirconium, and Hafnium. *S. L. Ausmus, F. W. Wood, and R. A. Beall.*** *U. S. Bureau of Mines Report of Investigations* 5686, 1960, 31 pp. (TN21 Un3r Room 290)

* **Effects of Methane Scrubbing in Molten Cast Iron on the Casting Property.** This process was found to improve the qualities of the castings and the mechanical properties of cast iron, to improve the compactness of the specimens, to reduce the tendency to shrinkage and stresses and to hot and cold cracking. In comparison to other methods, it is less expensive and causes the least decrease of temperature. (*In Italian.*) Influenza del gorgogliamento del metano nella ghisa liquida sulle proprietà di colata. *Founderia,* v. 9, Nov. 1960, p. 467-471.

Risering of Malleable Iron. ***Hans J. Heine and Robert A. Peacock.*** *Foundry,* v. 89, Jan. 1961, p. 82-89.

* **Aluminum-Uranium Alloy Centrifugal Casting.** Among the variables evaluated were melt temperature, mold and pouring spout configuration, mold speed and method of pouring. The best castings were produced using a pouring temperature of 2400 F, a heavy-walled steel cylinder rotating between 700 and 900 rpm for the mold and a bottom pouring technique employing a retractable pouring spout. ***N. E. Daniel, E. L. Foster, R. F. Dickerson.*** *Modern Castings,* v. 39, Jan. 1961, p. 53-59.

* **Steel Foundry Sand Clay Bonding.** Microscopic examination of steel foundry sands casts doubts on accepted theories on "clay film thickness" and "clay distribution" by mulling. Methods for microscopic examination are given. ***J. B. Caine, E. H. King, and J. S. Schumacher.*** *Modern Castings,* v. 39, Jan. 1961, p. 111-116.

* **Factors Affecting Metal-Mold Reactions.** The effect of an oxidizing mold atmosphere was demonstrated in the green sand castings by extensive reaction at the interface. The atmosphere produced by phenolic resin-bonded shell molds resulted in slight reaction and reaction products typical of a less oxidizing atmosphere than green sand molds. Manganese additions caused extensive silicate melt formation. ***G. A. Colligan, L. H. Van Vlack, and R. A. Flinn.*** *Modern Castings,* v. 39, Jan. 1961, p. 104-110.

* **Systematic Approach to Sand Design and Control.** Deals with the dry properties of clay-sand-water combinations. The systems covered in this report are those of western and southern bentonite and fireclay. ***A. H. Zrimsek and G. J. Vingas.*** *Modern Castings,* v. 39, Jan. 1961, p. 85-92.

* **Chilling Behavior of a Roll-Type Cast Iron.** An increase in superheating temperature from 2600 to 2900 F (1427-1593 C) increased the chill capacity of melts poured at 2450 F (1343 C). A decrease in pouring temperature from these superheating temperatures to 2450 F reduced chill depth. Superheating temperature did not markedly affect the structure of the white iron and gray iron portions of the chill test castings. ***K. E. Pinnow and R. W. Lindsay.*** *Modern Castings,* v. 39, Jan. 1961, p. 75-84.

* **Factors Affecting Soundness in Alloys With Long and Short Freezing Range.** Any rationalized approach to the problem of precise feeding of short-freezing-range alloys will have to account for the mold, as well as heat transfer, variables described in the present work such as mold cavity shape, mold materials, section thickness and metal cast. Previous methods of dimensioning have oversimplified this problem. In the production of castings of thick sections and high integrity, due consideration to the application of supplementary feed pressure to the risers should be given. ***J. T. Berry and T. Watmough.*** *Modern Castings,* v. 39, Jan. 1961, p. 63-74.

* **Granular Movement During Squeezing.** Granular movement during squeeze-molding operations is divided between a movement toward a horizontal direction and a movement toward a vertical direction. Author suggests that better squeeze compaction would be accomplished if squeeze boards were decreased in size to take advantage of greater sand movement. ***D. C. Williams.*** *Modern Castings,* v. 39, Jan. 1961, p. 60-62.

* **How to Grain Refine High Silicon-Aluminum Alloys.** Inherent coarse-grained structure of this alloy has discouraged its use for many years because of difficult machining. A new refining technique now makes the metal commercially useable for numerous cast engine parts. ***J. Sulzer.*** *Modern Castings,* v. 39, Jan. 1961, p. 38-42.

* **The Influence of Bismuth, Iron, Arsenic, and Antimony in Sand-Cast Gunmetals.** The influence of up to 0.1% of Bi, 0.3% of Fe, 0.6% of As, and 0.6% of Sb on the tensile properties, porosity, pressure-tightness, hot-tearing resistance, castability, and fluidity of 85-5-5-5 and 88-10-2 gunmetals was determined. None of these impurities had any effect on casting characteristics except that iron over 0.15% gave rise to small oxide inclusions. ***J. E. Stolarczyk, D. A. Hudson, and D. Ashbolt.*** *British Foundryman,* v. 53, Nov. 1960, p. 482-499.

* **Anomalous Expansion During the Cooling of Clay-Bonded Silica Sand.** It was found that when bentonite-bonded sand test-pieces are cooled from temperatures above that of the hot-strength peak, the contraction, due to the β-α quartz conversion, is followed by a marked expansion. No expansion was observed, however, with either material when it was cooled from temperatures below the peak, nor with clay-bonded olivine test-pieces in which no β-α contraction occurs. The practical importance of this effect is that it results in extreme friability and should facilitate stripping. ***J. Goodison and J. White.*** *British Foundryman,* v. 53, Nov. 1960, p. 477-479.

* **Testing Cast Iron for Steel Ingot Molds With Regard to Crazing Tendency.** Development of crazing on inner surface of cast iron molds. Testing procedure consisting of repeated heating and cooling make it possible to classify cast irons with respect to disposition towards crazing. (*In Swedish.*) Provning av gjutjärn för stålverkskokiller i avseende på benägenhet för nätighet. ***Åke Josefsson and Börje Backström.*** *Jerkontorets Annaler,* v. 144, no. 10, 1960, p. 739-756.

METALS—HEAT TREATMENT

* **Thermal Treatment of Low Carbon Electrotechnical Steel.** Annealing of this steel must be carried out in a decarburizing medium. In order to prevent the oxidation of parts during annealing, a mixture consisting of one part soft steel chips and two parts sand is recommended instead of using all cast iron chips. Rimmed steel must be annealed above the upper critical points. Increasing the annealing temperature from 900-920 C to 950-980 C causes embrittlement of the grain, decarburization and lower coercive strength. (*In Russian.*) Termicheskaia obrabotka maloudlerodistoĭ elektrotekhnicheskoĭ stali. ***N. P. Zhetvin, L. N. Podvoiskii, A. I. Paisov, and E. P. Kapustina.*** *Metallovedenie i Termicheskaia Obrabotka Metallov,* 1960, no. 11, Nov., p. 20-24 + 2 plates.

* **Development and Properties of Directly Hardenable Carburizing Steels.** Purpose and process of case hardening; development and properties of a directly hardenable carburizing steel as compared to conventional steels; carburization and quenching behavior; results of static and dynamic tests. (*In German.*) Entwicklung und Eigenschaften direkthärtbarer Einsatzstähle. ***Herbert Tauscher and Eberhard Stecher.*** *Neue Hütte,* v. 5, Oct. 1960, p. 596-607.

Heat Treatment of Cast Stainless Steels. II. Pertains to precipitation-hardenable martensitic stainless 17-4PH. ***W. P. James.*** *Precision Metal Molding,* v. 19, Jan. 1961, p. 39-41.

* **A Study by Electronic Diffraction and Microscopy of the Oxidation and Carburization of Thin Aluminum Films.** The authors after having investigated the condensation under vacuum of a thin Al film on an inert membrane—a process making possible a precise observation of the whole oxidation kinetics—offer a similar method by which a compound carbon-aluminum film is obtained. From 400 C a C_3Al_4 carbide was formed. Carburization practically occurs only at very high temperatures. The technique described was previously applied to Fe-C diffusion. (*In French.*) Étude par diffraction et microscopie électroniques de l'oxydation et de la carburation de films minces d'aluminium. ***J. J. Trillat, L. Tertian, and M. Bonnet-Gros.*** *Revue de l'Aluminium,* v. 37, no. 280, Oct. 1960, p. 1115-1123.

* **Malleableizing of Cast Iron in Gas-Tight Pots.** Results of tests confirmed the fitness of these pots as well as technical and economic advantages of annealing of castings of black-heart malleable cast iron. Plastic properties of castings annealed in

filling material are a little higher than properties obtained with annealing in gas-proof pots. (*In Czech.*) Temperování litiny v plynotěsných nádobách. ***Stanislav Drápal and Josef Rydlo.*** *Slévárenství*, v. 8, no. 11, Nov. 1960, p. 379-383.

* **Notes on Nitriding and Data About the Use of Cr-Mo Steel, Type F-125, as Nitrided Steel.** After nitriding, this steel exhibited high hardness and suitable depth of the layers formed, without high loss of strength or decrease of size. The best nitriding temperature was 525 C. (*In Spanish.*) Notas sobre nitruración y datos para utilización del acera Cr-Mo tipo F-124 como acero nitrurado. ***Enrique Garcia Sardinero.*** *Tecnica Metalurgica*, v. 16, no. 131, Sept.-Oct. 1960, p. 189-205.

METALS—MECHANICAL AND PHYSICAL PROPERTIES

* **Effect of Temperature or Stress Variations in Creep Testing. Applicability of the Progressive Action Method.** Applying the method of accelerating a test by increasing the influencing parameters, the results of creep testing by step variation of temperature and stress on a heat-resisting AISI 310 alloy are given. The results are related to the rupture time and permit calculation of cumulative fatigue damage as proposed by Miner. (*In Italian.*) Effetto delle variazioni della temperatura o della sollecitazione nelle prove di creep. Applicabilita del metodo ad azione progressiva. ***M. Alberghina.*** *Metallurgia Italiana*, v. 52, Oct. 1960, p. 651-655.

* **Influence of Technology on the Properties of Extruded Aluminum Alloy Bars Intended for Use in Forging Shops.** Lower extruding velocities are required to prevent coarse grains. The compressing ratio has to be decreased to a maximum value of 25. The most suitable extruding temperature is 420 C. Good lubrication of the die head is necessary. Manganese as an alloying element imparts favorable properties. (*In Czech.*) Vliv technologie na vlastnosti lisovaných tyči ze slitin hliníku pro použití v kovárnách. ***Josef Kreuter.*** *Hutnické Listy*, v. 15, no. 11, Nov. 1960, p. 851-857.

Irradiation Hardening in Copper and Nickel. Experimental data are compared with Seeger's theory of lattice hardening, which is based on dislocations cutting through a forest of obstacles under the action of both stress and thermal activation. The observed temperature dependence of the lattice hardening in both metals is in excellent agreement with the theory in the as-irradiated condition. It is concluded that the obstacles do not have a constant activation energy as assumed by Seeger. ***M. J. Makin and F. J. Minter.*** *Acta Metallurgica*, v. 8, Oct. 1960, p. 691-699.

Special Cast Irons. Heat, wear and corrosion resistant properties of six special cast irons—high chromium irons, Ni-Hard, Silal, high silicon irons, Nicrosilal, and acicular cast irons—are considered in relation to composition, heat treatment and production methods. Typical microstructures are illustrated and growth and scaling characteristics are discussed. ***R. Barton.*** *B.C.I.R.A. Journal*, v. 8, no. 6, Nov. 1960, p. 857-882.

* **Study of Steels With and Without Vanadium for Forgings.** Effect of additions of 0.03-0.08% V and 0.29% V on the mechanical properties of 50-200 mm dia. bars of carbon, Cr-Mo, and Cr-Ni-Mo steels. Because of the marked improvement in the properties resulting from the V addition, the quench treatment can in certain cases be replaced by normalizing and the temperatures raised. (*In French.*) Étude d'aciers avec et sans vanadium pour pièces de forge. ***G. Delbart, M. Jaspart, A. Clerc, and A. Constant.*** *Revue de Métallurgie*, v. 57, Oct. 1960, p. 885-909.

Survey of Various Special Tests Used to Determine Elastic, Plastic, and Rupture Properties of Metals at Elevated Temperatures. A comparison of test results determined by techniques which depend on (1) static and (2) dynamic measurements is presented. The effect of composition, grain size, and various transformations on the elastic moduli or their temperature dependence is discussed. A review of techniques and experimental data on the effects of high strain rates on plastic and rupture behavior of metal, and alloys at elevated

temperatures is presented. It is shown that recovery effects explain qualitatively the results obtained. A brief description of the various stages of recovery is also presented. The variation of hardness with temperature is discussed for pure metals and alloys, including a description of a typical hot-hardness tester. The relationship between hardness and tensile strength, creep, and creep-rupture behavior is briefly summarized. The use of the hot-hardness tester as a research tool for follwing solid-state reactions at elevated temperatures is discussed. These reactions may depend on temperature, time, or plastic strain or a combination of these. ***F. Garofalo.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 4, Dec. 1960, p. 867-881.

The Creep-Rupture Properties of 80 Ni-20 Cr Alloys. Two vacuum-melted and three air-melted alloys in a range of 1200-1800 were studied. Primarily as a result of melting practice small but important differences in minor constituents such as Si, Mn, S, and possible tramp elements occur. Of particular interest was the variation in ductility which the various alloys exhibited in creep-rupture tests which lasted from a few minutes to more than 1000 hr. A close examination of ductility behavior was undertaken by breaking down the creep curve into primary, secondary, and third-stage creep as a function of stress and temperature. It is shown that the stress-rupture properties are not affected over a wide temperature and stress range by a change in minor constituents, whereas the ductility behavior can vary considerably. ***Robert Widmer and Nicholas J. Grant.*** *ASME, Transactions, Series D. Journal of Basic Engineering*, v. 82, no. 4, Dec. 1960, p. 829-838.

The Extrapolation of Families of Curves by Recurrence Relations, With Application to Creep-Rupture Data. By using finite-difference recurrence relations, it is shown that good results can be obtained without the necessity for any of the usual parameter concepts. ***A. Mendelson and S. S. Manson.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 4, Dec. 1960, p. 839-847.

Some Observations on the Extrapolation of High-Temperature Ferritic Steel Data. Discussion of proposals for the use of combined creep and rupture data. Use of the Monkman-Grant relationship to analyze some extensive creep and rupture data obtained on several ferritic steels. Comparisons are drawn with results obtained using the Larson-Miller and Manson-Haferd parameter methods. ***Robert M. Goldhoff.*** *ASME, Transactions, Series D, Journal of Basic Engineering*, v. 82, no. 4, Dec. 1960, p. 848-854.

The Bearing Properties of 1% C-Cr Steel as Influenced by Steelmaking Practice. A fatigue rig, which simulates in simple form the conditions applying in the case of bearing endurance tests and produces the same type of failures, was developed. Tests were carried out on standard 1%C-Cr quality steel to explore the effect of different steelmaking procedures and, in the case of basic electric arc steels, the effect of deoxidation practice on the performance of the material. ***R. F. Johnson and J. F. Sewell.*** *Iron and Steel Institute, Journal*, v. 196, pt. 4, Dec. 1960, p. 414-444.

Heat Treatment of Steels. II. Steel Selection. Criteria for steel selection and tabular data for comparison of commonly used carbon and alloy steels. ***Lester F. Spencer.*** *Machine Design*, v. 32, Dec. 22, 1960, p. 120-125.

Rupture of Silicon-Iron Sheets and Related Creep Phenomena. Intercrystalline cracking is only promient below 650 C, while necking dominates rupture at higher temperatures. The major structural changes during creep may be migration and serration of grain boundaries, polygonization, recrystallization, and grain coarsening, depending on the temperature. ***C. W. Chen.*** *Iron and Steel Institute, Journal*, v. 196, pt. 4, Dec. 1960, p. 385-389.

* **Viscosity and Electric Conductivity of Aluminum-Antimony, Gallium-Antimony, and Indium-Antimony Alloys in the Molten State.** These properties were studied as a function of temperature and concentration. The general character of the intermolecular interaction at different temperatures was examined. The properties of the alloys are conditioned mainly by the state of the electrons in the melt. (*In Russian.*) Vizkost' i elektroprovodnost' splavov aliuminiĭ-sur'ma, galliĭ-sur'ma i indiĭ-sur'ma v zhidkom sostoianii. ***V. M. Glazov.*** *Akademiia Nauk*

SSSR, Otdelenie Tekhnicheskikh Nauk, Izvestiia, Metallurgiia i Toplivo, 1960, no. 5, Sept.-Oct., p. 190-194.

* **Plastic Yielding in Anelasticity.** By means of the application of a yield criterion, according to which yielding takes place when that part of the stress-work which is conserved reaches a definite maximum value, it is shown that from the constitutive equation of anelasticity two phenomena follow. On one hand, when the load is constant, yielding can take place after some some time in creep. On the other hand, when a constant rate of strain is applied, the yield stress increases with the rate of strain. ***M. Reiner.*** *Journal of the Mechanics and Physics of Solids,* v. 8, no. 4, Nov. 1960, p. 255-261.

* **Assessment of the Strain-Rate Sensitivity of Metals by Indentation With Conical Indenters.** An analysis of impact indentation is made, using a quasi-stationary approach; relations between impression dimensions, contact duration and impact velocity are obtained and verified experimentally. Comparison of the impact test results with those derived from hardness measurements, using the same indenter, affords an assessment of the strain rate sensitivity of the material. ***C. D. Davis and S. C. Hunter.*** *Journal of the Mechanics and Physics of Solids,* v. 8, no. 4, Nov. 1960, p. 235-254.

* **The Hertz Problem for a Rigid Spherical Indenter and a Viscoelastic Half-Space.** The penetration of a viscoelastic half-space by a rigid spherical indenter is investigated in a quasi static approximation. Solutions to the problem are obtained for monotonic contact radius and also when the radius possesses a single maximum. The analysis is used to estimate the duration of contact and coefficient of restitution for the Hertzian impact of a spherical indenter on a Maxwell solid. ***S. C. Hunter.*** *Journal of the Mechanics and Physics of Solids,* v. 8, no. 4, Nov. 1960, p. 219-234.

The Role of Atmosphere in the Creep-Rupture Behavior of 80 Ni-20 Cr Alloys. Microstructure was studied after creep at 1500 and 1800 F with respect to the influence of atmosphere. In particular the propagation of intercrystalline cracks was investigated. By comparison with tests conducted in Ar it can be shown that the atmosphere has a strengthening effect in all cases. The mechanism of this effect changes with the variation of minor constituents in the metals (such as Si and Mn/S ratio). Crack propagation is strongly affected by the melting process, which influences the purity of the grain boundaries. ***Robert Widmer and Nicholas J. Grant.*** *ASME, Transactions, Series D, Journal of Basic Engineering,* v. 82, no. 4, Dec. 1960, p. 882-886.

* **Heat Resistance of Alloys in the Titanium-Tin System.** The heat resistance of Ti-Sn alloys increases with Ti concentration in the α-solid solution. The alloys near the limit of specific solubility have maximum heat resistance. Alloys with a definite two-phase structure in the form of coarse inclusions in the second phase have lower heat resistance. An alloy based on a solid solution of the Ti_3Sn compound has the highest heat resistance at any temperature of testing. (*In Russian.*) Zharoprochnost' sylavov sistemy titan-olovo. ***I. I. Kornilov and T. T. Nartova.*** *Akademiia Nauk SSSR, Otdelenie Tekhnicheskikh Nauk, Izvestiia, Metallurgiia i Toplivo,* 1960, no. 5, Sept.-Oct., p. 133-136.

* **Rare Metals in Heat Resisting Alloys.** The rare metals can be used as a basis for heat resisting alloys or as modifying, deoxidizing, desulfurizing, degassing, and strengthening additions. High-melting rare metal compounds have possibilities as heat resisting materials. (*In Russian.*) Redkie metally v zharoprochnykh splavakh. ***E. M. Savitskii.*** *Akademiia Nauk SSSR, Otdelenie Tekhnicheskikh Nauk, Izvestiia, Metallurgiia i Toplivo,* 1960, no. 5, Sept.-Oct., p. 52-69.

The Mechanical Properties of Some Tempered Alloy Martensites. High-purity steels offer significant improvements in impact properties, in tensile ductility, and in notch sensitivity as indicated by notched tensile tests. ***J. M. Capus and G. Mayer.*** *Iron & Steel,* v. 33, no. 14, Dec. 19, 1960, p. 665-668.

* **Bibliography on Low Temperature Characteristics of Steels, 1904-April, 1960.** 1227 References. Author Index. ***Katherine Janis Faber.*** 3rd Ed. 107 pp. 1960. The International Nickel Co., Inc., New York. (ZTN731 In8b3 Ref.)

a • * **New Methods for Creep Testing.** Describes methods for long-time extrapolation of creep curves, examines the Larsen-Miller method, determines the constant's value as a function of temperature, stress and time up to the breaking point. This constant varies between 15 and 30 for the same alloy. Larsen-Miller and Glen methods are compared and newly developed extrapolation methods are given. (*In French.*) Nouvelles methodes d'approche des problemes posés par les essais de fluage. ***W. Siegfried.*** *Metallurgia Italiana,* v. 52, Oct. 1960, p. 640-646.

b • **Studies of Hot Cracking in High-Strength Weld Metals.** Use of freezing-cycle hot-tension machine indicates combined sulfur-phosphorus content below 0.025% prevents hot cracking. ***H. W. Mishler, R. E. Monroe, and P. J. Rieppel.*** *Welding Journal,* v. 40, Jan. 1961, p. 1s-7s.

c • **Brittle Fracture Characteristics of a Reactor Pressure-Vessel Steel.** For test conditions used, A302B steel proves more brittle-fracture resistant than other steels. ***E. T. Wessel and W. H. Pryle.*** *Welding Journal,* v. 40, Jan. 1961, p. 41s-48s.

d • **The Effect of Casting Variables and Heat Treatment on the Tensile Properties of Lead-0.02 to 0.10 Weight Per Cent Calcium Alloy.** Alloys having 0.06 to 0.09 wt.% Ca were found to respond to solution heat treatment, room temperature precipitation hardening, and accelerated hardening at 100 C. Tensile strengths to 7,000 psi were obtained. ***Allen B. Townsend.*** *U. S. Atomic Energy Commission,* Y-1307, Feb. 25, 1960, 25 pp. (UF767 Un3.1y Contin.)

e • * **Effects of Deformation Aging on Processes Occurring During Cyclic Stressing of Steel.** The internal processes occurring during applied alternating bending loads were studied on an unalloyed steel with 0.22% C by measuring the modulus of elasticity and damping within the kilocycle range. The effects of amount of loading, time, and resting periods were determined. The results are interpreted in terms of the dislocation theory. (*In German.*) Einfluss einer Verformungsalterung auf der Vorgänge bei der Wechselbeanspruchung von Stahl. ***Hermann Schenck, Eugen Schmidtmann, and Hans Kettler.*** *Archiv für das Eisenhüttenwesen,* v. 31, no. 11, Nov. 1960, p. 659-669.

f • **Anisotropy of Steel Sheets Designed for Deep Drawing.** Defects are discussed and methods suggested for improving technology and reducing the number of rejects. (*In Czech.*) Některé otázky anizotropie hlubokotažného plechu. ***S. A. Valijev.*** *Strojírenství,* v. 10, no. 11, Nov. 1960, p. 842-846.

g • **Recent Developments in Superalloys.** Highlights some of the newer superalloys—nickel base and cobalt base—and discusses some of their important properties and characteristics. ***H. J. Wagner.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Memorandum* 64, Sept. 8, 1960, 16 pp. (TN799 B32.2d Contin.)

h • * **Influence of Arsenic, Phosphorus and Carbon on Properties of Steel.** The presence of even small quantities of As in the high P content (0.060%) steel considerably reduces elastic properties. (*In Russian.*) Vliianie mysh'iaka hofpoa i uglevoda na svoistva stali. ***K. F. Starodubov and V. V. Kalmykov.*** *Stal',* v. 20, no. 11, Nov. 1960, p. 1034-1037.

i • **Properties of Some Copper Alloys at Elevated Temperatures.** Provides design engineers with reasonably correct information covering the short-time mechanical strength and electrical resistivity of a number of commercially available copper alloys at temperatures up to 500 C. ***C. H. Crowe.*** *ASTM Bulletin,* no. 250, Dec. 1960, p. 30-31.

j

METALS—MECHANICAL WORKING

k • * **Effects of Ultrasonic Vibrations on Grinding Heat Resisting Alloys.** During flat grinding of these alloys, in order to increase the smoothness of the machined surface and to eliminate grinding cracks, it is useful to create vibrations of high or ultrasonic frequency and low amplitude in the tool-billet system; the surface roughness is decreased 1.5 to 2 times and the cutting force and temperature are lowered. The wear of the

grinding wheel increases by a factor of about 1.5. (*In Russian.*) Vliianie ul'trazvukovykh kolebaniĭ na protsess rezaniia zharoprochnykh splavov. ***A. A. Voronin and A. I. Markov.*** *Stanki i Instrument,* v. 31, no. 11, Nov. 1960, p. 15-17.

* **Cold Heading and Cold Extrusion of Wire.** Experimental deformation pressure from dynamic tool load measurements. ***John C. McMurray.*** *Wire and Wire Products,* v. 35, Dec. 1960, p. 1649 + 5 pages.

Roll Forces and Torques in Hot Rolling. Analyzes results obtained in rolling with heavy passes and shows that some generally accepted formulae do not apply under these conditions; the torque curve rises steeply with increasing severity of pass. ***Z. Wusatowski and B. Hoderny.*** *Iron & Steel,* v. 33, no. 13, Dec. 1960, p. 578-581.

* **Turning Hardened Tool Steels With Ceramic Tools.** Ceramic tools with large negative rakes have excellent life, even when cutting materials as hard as R_c 61. ***Fenton L. Bagley, Jr.*** *Tool and Manufacturing Engineer,* v. 46, no. 1, Jan. 1961, p. 99-101.

* **Plastic Tooling for the Job Shop.** Use of plastics for orthodox job-shop tooling saves time; the fabrication of plastics tools is simple. ***R. M. Radl.*** *Tool and Manufacturing Engineer,* v. 46, no. 1, Jan. 1961, p. 91-93.

The Application of Steel Extrusions. Description of the various applications and advantages of the use of extrusions. ***R. D. C. Jones.*** *Welding and Metal Fabrication,* v. 28, Dec. 1960, p. 495-498.

Fillet Rolling. Design factors for a cold-working process that induces residual stresses in critical areas of shafts to improve fatigue life. ***Walter Egger and Gerald X. Diamond.*** *Machine Design,* v. 33, Jan. 5, 1961, p. 112-119.

* **Trial for a Definition of Drawability.** Three easy drawability tests are proposed: tension on wide specimen, Jovignot biaxial hydrostatic extension, and modified Guyot test; one is enough for a particular drawing test. Also, a practical cup test is proposed, considering two opposite cases: ungreased cylindrical punch or greased elliptic punch, and this according to two different scales; for a given problem, only one of these tests is sufficient. (*In French.*) Essai de définition de l'emboutissabilité. ***J. Pomey, A. Royez, and P. Dhez.*** *Revue de Métallurgie, Mémoires Scientifiques,* v. 57, no. 10, Oct. 1960, p. 741-754.

* **New Developments in Copper Wire Rod Mills.** An outline of the mechanics, economics and capabilities of modern wire rod rolling equipment. ***M. M. Feuer.*** *Wire and Wire Products,* v. 35, Dec. 1960, p. 1675-1677.

* **Sintered Tungsten Carbide Dies in the Wire Industry.** Surveys dies used in wire drawing. Gives a few specific designs. ***Edgar T. Miller.*** *Wire and Wire Products,* v. 35, Dec. 1960, p. 1668 + 3 pages.

Hydraulic Horizontal Extrusion Presses. Types of presses, production processes, press design, auxiliary equipment, production cycles, drives, and controls. ***Walter Dohrn and Heinz Schmoll.*** *Light Metal Age,* v. 18, Dec. 1960, p. 11-16.

Principles of Template Preparation for the Oxygen Cutting Process. . . . for machine shape cutting with edge and line tracers. ***L. M. Layden.*** *Welding Journal,* v. 40, Jan. 1961, p. 34-40.

Multimetal Parts Stamped From Clad Metal Strip. A preassembled sandwich can be an economical way to get the metals you want—in the positions you want them—for high bond strength and close dimension control. ***Brian Coad.*** *Product Engineering,* v. 32, no. 2, Jan. 9, 1961, p. 69-71.

Forging Steel at Elevated Temperatures. Tests show that even a very substantial increase in forging temperature does not impair the toughness of steel. (*In Czech.*) Ocelové výkovky kované za zvýšených teplot. ***V. Hašek.*** *Strojírenství,* v. 10, no. 11, Nov. 1960, p. 835-837.

* **The Elastic Deformation of 4-High Rolling Mill Rolls.** Experimental study of a rolling mill having 300 mm diameter rolls with surfaces ground parallel, to determine the stress distribution along the line of contact between work roll and back-up roll. It was found that the bending of the work roll was three times that of the back-up roll, as calculated from conventional formulas. With short stubby rolls the phenomena of flattening produced deformations of the same order as bending and shearing. (*In French.*) Mise en évidence des phénomènes de flexion et d'aplatissement de cylindres sur un laminoir quarto. ***B. Fazan.*** *Revue de Métallurgie,* v. 57, Nov. 1960, p. 1003-1018.

* **Structural Processes in the Hot Rolling of Rimming Steel Sheet.** Holding at an adequately high temperature after deformation produces a recrystallization which depends on the amount of the deformation. If no coarse grain is found, the coiling temperature must have been low but subsequent annealing would be unfavorable. In the latter case, normalization corrects the work hardening by a change of phase. (*In French.*) Phénomènes structuraux liés au laminage a chaud des tôles en acier effervescent. ***U. Berruti, S. Michelucci, and G. Odone.*** *Revue de Métallurgie,* v. 57, Nov. 1960, p. 1019-1031.

* **Effects of Aluminum Nitride on the Forgability of Steels.** The decrease of forgeability in steels due to the addition of Al between 0.0045 and 0.090% is studied for steels with 0.35% C. The characteristics of the process are determined. Plasticity decreases when AlN begins to dissolve, and is reestablished when this nitride is completely dissolved at 1150-1200 C. (*In French.*) Influence de nitrure d'aluminium sur la forgeabilité des aciers. ***Paul Bastien and Philippe Portevin.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 251, no. 21, Nov. 21, 1960, p. 2347-2349.

New Ways of Cutting Metal. Reviews chemical, electrical and explosive methods, and shows what benefits they offer to industry. ***David Fishlock.*** *New Scientist,* v. 8, Dec. 8, 1960, p. 1535-1537.

* **Problems in Connection With the Measurement of Variable Cutting-Edge Forces of Tools.** ***E. Bickel.*** *Microtecnic* (English Edition), v. 14, no. 5, Oct. 1960, p. 226-232.

* **The Use of an Irremovable Mandrel for Secondary Piercing of Tube Billets.** These mandrels, designed at the Transcaucasian Iron and Steel Works, last four-five times longer than the ordinary removable ones. The use of the irremovable mandrels enabled the process of the secondary piercing to be automatized. (*In Russian.*) Primenenie nesmeniaemoi opravki pri vtorichnoi proshivke gil'z. ***A. N. Borovkov, P. A. Tsereteli, E. A. Svetlitsky, A. Ie. Ubiria, and I. I. Kovbassa.*** *Stal',* v. 20, no. 11, Nov. 1960, p. 1022-1023.

* **Automation of Control of Mechanisms in Automatic Tube Rolling Installations.** (*In Russian.*) Avtomatizatsiia upravleniia mekhanizmami avtomaticheskikh truboprokatnykh ustanovok. ***F. B. Martsinchik.*** *Stal',* v. 20, no. 11, Nov. 1960, p. 1014-1021.

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

* **Precipitation Hardening of Low-Carbon Steel.** Hardening of low-carbon steel with a low N content occurs by carbide phase formation. The determined activation energy of the precipitation process is very similar to the activation energy of C diffusion in α-Fe. (*In Czech.*) Precipitační vytvrzování nízkouhlíkove oceli. ***Mirko Klesnil and Přemysl Ryš.*** *Hutnické Listy,* v. 15, no. 11, Nov. 1960, p. 867-876.

Fabrication and Annealing Factors Affecting Grain Size of 18Cr8Ni-Ti Superheater Materials in Steam Boilers. It is shown that cold-drawn tubing retains a relatively uniform small grain size at annealing temperatures up to about 1900 to 1950 F and that above this temperature individual grains begin to grow at an accelerated rate, leading to a mixed grain-size structure. Annealing times between 5 and 15 minutes caused only insignificant differences in the over-all grain size, but extension of exposure to 30 minutes produced a noticeably larger grain structure. Small cold deformations as may be introduced into the material by tube straightening can, when followed by a final anneal, cause excessive localized grain enlargements. Observa-

tions pointed to the possibility that materials with high Ti/C ratios may retain a predominantly small grain size at annealing temperatures as high as 2050 F. ***F. Eberle and J. S. Makris.*** *ASME, Transactions, Series D, Journal of Basic Engineering,* v. 82, no. 4, Dec. 1960, p. 855-866.

* **The Effects of Molybdenum, Wolfram and Copper on the Solubility of Graphite in Liquid Iron and a Method for Calculation of the Activity Coefficient of Carbon in Multicomponent Alloys.** Interaction parameters at graphite saturation and a general approximate equation for calculating the activity coefficient of C in a multicomponent alloy were determined. ***Toshisada Mori, Kan Aketa, Hitoshi Ono, and Hiroshi Sugita.*** *Kyoto University. Memoirs of the Faculty of Engineering,* v. 22, pt. 4, Oct. 1960, p. 401-421.

* **Structure Modifications Occuring in High Purity and Zone-Refined Aluminium During Annealing After Cold-Work.** The phenomena occurring during the annealing of high purity Al, after a severe cold-work at low temperatures, have been studied by low-temperature electrical resistivity measurements, metallography and X-ray diffraction. In the Al refined by zone-melting, an elimination of point defects can be observed, followed by recrystallization, which takes place at temperatures lower than room-temperature, and with a low activation energy. (*In French.*) Évolution structurale, au cours de traitements thermiques après écrouissage de l'aluminium à haut titre et de zone fondue. ***Omourtague Dimitrov.*** *Revue de Métallurgie, Mémoires Scientifiques,* v. 57, no. 10, Oct. 1960, p. 787-807.

* **Cristallographic Relationship Between the γ-Phase and the α-Phase Obtained by Application of Cold Work on Instable Austenit.** The preferred orientations found between austenit and α-phase obtained by wire-drawing are given. These orientations are determined in quantity by an original method. A transformation theory is given with all results. In making use of "Bain-model" and "dislocations-transformations", Young modulus and damping capacity determinations permit verification of this theory. (*In French.*) Relations cristallographiques entre la phase gamma et la phase alpha d'écrouissage d'une austénite instable. ***P. Bastien and R. Margerand.*** *Revue de Métallurgie, Mémoires Scientifiques,* v. 57, no. 10, Oct. 1960, p. 778-786.

* **Application of a Practical Method for Measuring the Diffusion of Hydrogen Through Mild Steel Sheet.** A report on recent tests and the development of a method which ensures accuracy and reproducibility for measuring the permeability of mild steel sheet to H. The adopted method can be applied to testpieces of large dimensions. The method was used for studying the effect of workhardening and grain size on the permeability and also the deterioration due to massive diffusion of H. (*In French.*) Application d'une méthode pratique pour la mesure de la diffusion d'hydrogène au travers de tôles minces en acier doux. ***P. E. Lagasse and L. Lilet.*** *Revue de Métallurgie, Mémoires Scientifiques,* v. 57, no. 10, Oct. 1960, p. 729-740.

Liquidus and Solidus Relations in Iron-Rich Iron-Carbon Alloys. The equilibrium diagram of iron-rich iron-carbon alloys was determined by a combination of the methods of thermal analysis and microscopical examination of quenched specimens. The results are in good agreement with the curves given in other recent work, and confirm that Hansen was correct in rejecting experimental points. ***R. A. Buckley and W. Hume-Rothery.*** *Iron and Steel Institute, Journal,* v. 196, pt. 4, Dec. 1960, p. 403-406.

* **Effects of Ultrasonics on the Crystallization and Properties of Metals and Casting Alloys.** To investigate the influence of ultrasonics on the structure and mechanical properties (R_r and HB) of zinc and LAl and LA63 alloys magnetostriction generator with an acoustic power of 40 W and a vibration frequency of 21 kHz was applied. Samples with 18 mm diameter, cast in dies, subjected to the influence of sounds display a marked refinement of the structure under this influence, and an increase in tensile strength on the average of 19.5% and of hardness of 5%. (*In Polish.*) Wpływ ultradźwięków na krystalizację i własności metali i stopów odlewniczych. ***Paweł Murza-Mucha.*** *Przegląd Odlewnictwa,* v. 10, no. 12, Dec. 1960, p. 345-353.

a • * **X-Ray Investigations on the Setting Process of Silver-Tin Amalgams. I.** X-ray investigation methods and their limits on the observation of crystallization processes, the system silver-tin, the determination of liquid mercury, the system silver-mercury, investigations of the authors are discussed. (*In German.*) Röntgenographische Untersuchungen über den Abbindevorgang bei Silber-Zinn-Amalgamen. I. ***H. Winterhager and R. Dreiner.*** *Metall,* v. 14, Dec. 1960, p. 1157-1162.

b • * **Isothermic Decomposition of Austenite in Some Bearing Steels.** The three steels studied had the following compositions: 1.05% C, 0.54% Cr; 1.01% C, 1.54% Cr; 0.93% C, 1.55% Cr, 0.55% Si, 1.1% Mn. Kinetic curves were obtained by a thermomagnetic method. Microstructure and hardness were investigated also. On the curve of the incipient transformation of these steels, a characteristic point near 335 C revealed the passage from the upper domain to the lower domain of the intermediary interval. (*In Rumanian.*) Sfărimarea carburii de fier şi relaţile ei cu variaţiile

c • punctului curie şi cu unele rezultate experimentale obţinute de andrew şi lee. ***Alois Mašin and Olga Bakaliková.*** *Academia Republicii Populare Romine Centrul de Cercetări Metalurigce, Studii şi Cercetări de Metalurgie,* v. 5, no. 3, 1960, p. 313-319. + 1 plate.

d • **The Martensite Transformation in Carbon Steels.** It was found that the martensite in low-carbon steels forms predominantly as long needles parallel to $<111>_{\gamma}$, while in the high-carbon steels it forms as plates internally twinned on a fine scale. The existence of these narrow twins in the high-carbon martensites enables the transformation mechanism to be derived uniquely. ***P. M. Kelly and J. Nutting.*** *Royal Society, Proceedings,* v. 259, ser. A, Nov. 22, 1960, p. 45-58 + 4 plates.

e • **Order and Disorder. I. Theory of Stacking Faults and Diffraction Maxima.** From formal postulates about a three-dimensional set of stacking faults, expressions are derived giving the intensity as a function of direction in reciprocal space, and from these the position, breadth and heights of the maxima are obtained in terms of the fault probability and slip vector. Shows that random faulting only gives reasonably strong sharp maxima

f • when the displacements from Bragg maxima are fairly small. ***Helen D. Megaw.*** *Royal Society, Proceedings,* v. 259, ser. A, Nov. 22, 1960, p. 59-78.

g • **Discontinuous Mode of Dissolution of a β Phase Precipitate Into α Cu-Cd Solid Solutions.** The process occurs by formation of dissolved regions, nearly simultaneously, at all the matrix grain boundaries and growth of regions, at time-independent rate, into the grain interiors. The dependence of isothermally dissolved volume fraction x on solution time t agrees with a kinetic law of form $x = 1 - \exp(-Bt^{1 \cdot 1})$, B being a parameter. ***M. S. Sulonen.*** *Acta Metallurgica,* v. 8, Oct. 1960, p. 669-676.

h • **The Lattice Spacing Relationships in Close-Packed α and ζ Phases Based on Gold.** Results show that in the Au-Sn system the axial ratio and the a and c spacings charge with increasing electron concentration in a similar manner to that observed earlier in Au-In alloys. ***T. B. Massalski and H. W. King.*** *Acta Metallurgica,* v. 8, Oct. 1960, p. 677-683.

i • **Lattice Spacing Relationships and the Electronic Band Structure of Close-Packed α and ζ Phases of Gold-Based Alloys.** The lattice spacing relationships in the α and ζ alloys based on gold are discussed in the light of previous similar studies. Shows that the systematic deviations $\Delta a'$, $\Delta c'$, and Δa, observed in the lattice spacings of the ζ alloys, can be

j • interpreted in terms of the interactions of the Fermi surface with the faces of the Brillouin zone of the c.p.hex. structure. When the present results are reviewed in the light of the band structure theory they indicate that, similarly to the interpretation of Cohen and Heine, the Fermi surface must be considerably more distorted in the gold-based alloys than in alloys of copper of copper or silver. ***T. B. Massalski and H. W. King.*** *Acta Metallurgica,* v. 8, Oct. 1960, p. 684-690.

k • **Precipitation in Gold-Platinum Alloys. I. Thermodynamics. II. Influence of the Spinodal Curve on the Rate and the Mechanism of the Precipitation Process.** An expression is derived for the increase in the Gibbs' free energy which arises from the mixing of a total amount of 1 mole of the components of a binary system. The six constants of this ex-

pression are calculated for the gold-platinum system from experimental data. An exposition is given of the theories of Borelius and Tichelaar and of the considerations put forward by Dehlinger, et al., and Cohen. The experimental conditions of the present investigation are outlined, after which a description of the results is given with the aid of a large number of X-ray photographs. I. ***L. J. Van Der Toorn and T. J. Tiedema.*** II. ***L. J. Van Der Toorn.*** *Acta Metallurgica*, v. 8, Oct. 1960, p. 711-727.

* **Structural Changes and Corrosion Resistance of Steel Kh17N2.** Heating this steel up to 1000-1300 C during a 1 to 5 min. soaking process and subsequent cooling in the air produces a martensite structure (microhardness 545 to 649 kg/cm^2, decreasing the toughness of the metal to 0.36-0.60 kgm/cm^2. Tempering between 300 and 600 C from the martensite, causes precipitation of dispersed Cr carbides and impoverishment by Cr of the masic martensite mass. The structure of the tempered martensite has low corrosion resistance. (*In Russian.*) Strukturnye izmeneniia i korrozionnaia stoĭkost' stali Kh17N2. ***A. P. Akshentseva.*** *Metallovedenie i Termicheskaia Obrabotka Metallov*, 1960, no. 11, Nov., p. 7-12.

* **Structural Transformations of Thin Layers of Tungsten.** The authors used the energy of the electron beam in the electron microscope to heat-treat thin W layers, and observed the processes of reduction of WO_3 to WO_2, occurring through the formation of two intermediate stable oxides, and that of WO_2 to α-W, occurring through the intermediate formation of the β-modification of W. The results obtained with the electron microscope show that the equilibrium form of α-W crystals is the rhombododecahedron, that of WO_2 is the trigonal pyramid or the tetrahedron, and that of WO_3 is the rhomobohedral prism. ***A. I. Andrievskii and I. D. Nabutovich.*** *Soviet Physics - Solid State (Cover-to-cover translation of Fizika Tverdogo Tela)*, v. 2, Nov. 1960, p. 892-895.

* **The Problem of Evaluating Cast Iron and the Role of Secondary Grain Structure.** General considerations on quality of cast iron; comparison of the degree of normality of cast irons produced under different metallurgical conditions; brinell hardness and secondary structure; degree of normality, mechanical behavior and ferritization of cast iron; new ways of producing high-quality irons. (*In German.*) Das Problem der Bewertung des Gusseisens und die Rolle des Gefüges der Grundmasse. ***Albert Collaud.*** *Giesserei*, v. 47, no. 25, Dec. 15, 1960, p. 719-732.

* **Malleable Iron Graphitization Kinetics.** Trace amounts of the elements Bi, Sb, Sn, Pb, Cd, and Zn were studied for their effects on the kinetics of each of the three graphitization reactions critical to the malleabilization of irons. The results show that some of the trace elements react with S in irons with low Mn-S ratios and others do not. The trace elements do not form sulfides in irons with high Mn-S ratios. ***G. Sandoz, B. F. Brown, and W. A. Pennington.*** *Modern Castings*, v. 39, Jan. 1961, p. 93-103.

The Influence of Solutes on Self-Diffusion in Metals. A statistical theory based on the vacancy model used previously by Hoffman, Turnbull and Hart, is given and includes a qualitative consideration of correlation effects. Two limiting cases are considered: (1) in which the vacancy jump frequencies are not greatly changed by the solute atoms ("weak perturbation" limit); (2) in which the vacancies attach themselves strongly to solute atoms and where the jump frequencies may be greatly different ("tight-binding" limit). ***A. B. Lidiard.*** *Philosophical Magazine*, v. 5, ser. 8, Nov. 1960, p. 1171-1180.

* **The Kinetics and Mechanism of the Reaction Between Sulfur and the Silver-Zinc Alloys.** Investigated the kinetics of sulfurization of the Ag-Zn alloys containing from 6.0 to 68.5 at.% Zn. The rate of the sulfurization was measured by the balance method. Rate measurements were carried out for the whole concentration range of the investigated alloys at the temperature of 444 C. (*In Polish.*) Kinetyka i mechanizm reakcji pomiędzy siarką i stop ami srebra z cynkiem. ***Stanisław Mrowec, Krystayna Wallisch and Teodor Werber.*** *Archiwum Hutnictwa*, v. 5, no. 4, 1960, p. 323-344.

a • * **Heats of Formation in the Aluminum-Zinc System at 330, 370 and 430°° C. XV. Contributions to the Energetic Study of Metallic Systems.** So called ξ-functions show marked changes in behavior above and below a VEC of 2,6. Solid solutions of Ag in Al exhibit almost the same dependency on VEC. Increase of heats of formation with temperature may be due to formation of lattice defects or larger expansion of the lattice than in pure Al. (*In German.*) Bildungswärmen im System Aluminium-Zink bei 330, 370 und 430°. XV. Beiträge zur Energetik metallischer Systeme. ***Franz Eberhard Wittig and Leopold Schöffl.*** *Zeitschrift für Metallkunde*, v. 51, Dec. 1960, p. 700-707.

b • * **Investigation of Slips in Single Crystallites of Polycrystalline Copper Specimens.** The slip planes activated during tensile deformation of polycrystalline pure Cu specimens have been determined. In many cases, slip took place only in others than the primary system. The effective shearing stress in the observed slip systems was compared to the shearing stress in the primary system. Nonoctahedral slip has been observed in two out of sixty cases. (*In German.*) Untersuchung von Gleitvorgängen in Einzelkristalliten vielkristalliner Kupferproben. ***Randolf J. Hartmann and Eckard Macherauch.*** *Zeitschrift für Metallkunde*, v. 51, Dec. 1960, p. 694-699.

c • * **A Study of the Behavior of Indium and Antimony Impurities in Germanium by Means of Electrodiffusion.** The specimens were prepared with single Ge crystals with a locally introduced impurity, and tested at 300-600 and 800-900 C. Below 600 C, In moves toward the anode, Sb toward the cathode. Then there is a change in the direction of transfer and above 800 C, In moves to the cathode and Sb to the anode. The number of impurity atoms have abnormally high mobility, which does not correspond to the diffusion coefficient measured concerning In and Sb in Ge. (*In Russian.*) Izuchenie povedeniia primesei indiia i sur'my v germanii metodom elektrodiffuzii. ***B. P. Konstantinov and L. A. Badenko.*** *Fizika Tverdogo Tela*, v. 2, no. 11, Nov. 1960, p. 2696-2702.

d • **The Fermi Surface in White Tin.** The orientation dependence of the de Haas-van Alphen periods in tin single crystals was studied in high pulsed magnetic fields. Effective mass values were determined at the principal orientations from the temperature dependence of the amplitudes; these are compared with the results of cyclotron resonance experiments and with the free-electron orbit masses. ***A. V. Gold and M. G. Priestley.*** *Philosophical Magazine*, v. 5, ser. 8, Nov. 1960, p. 1089-1104.

e • **Neutron Diffraction Studies of Chromium-Modified Mn_2Sb.** Existence of a ferrimagnetic to antiferromagnetic phase transition with decreasing temperature in Mn_2Sb modified with 2.3 wt.% Cr is confirmed by neutron diffraction. ***W. H. Cloud, H. S. Jarrett, A. E. Austin, and E. Adelson.*** *Physical Review*, v. 120, 2nd ser., no. 6, Dec. 15, 1960, p. 1969-1970.

f • * **Structural Modifications Observed by Electron Microscopy During the Annealing of Highly Work-Hardened Iron.** The structure of such Fe is made, as in the case of highly deformed Al, of small blocks whose individual identity increases with the purity of the metal. The work-hardened structure of Armco Fe can be improved by annealing at a temperature lower than that of crystallization. On the other hand, the recrystallization of melted zone Fe occurs directly inside the work-hardened matrix. (*In French.*) Sur les modifications de structure observées par microscopie électronique au cours du recuit du fer fortement écroui. ***Christian Messager and Paul Morgand.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 23, Dec. 5, 1960, p. 2701-2703.

g • * **Micrographic Aspect of a Magnesium-Zirconium Mixture Heated in Hydrogen.** By means of an electron microscope examination it was possible to determine the shape, distribution and metallurgical properties of zirconium hydride precipitated by heating the H of a Mg-Zr alloy. The hydride separates as small plates having increasing hexagonal symmetry; they are identical to those produced by precipitation in slightly hydrogenized Zr. (*In French.*) Aspect micrographique d'un alliage magnésium-zirconium chauffé dans l'hydrogène. ***Pierre Lelong, Jean Dosdat, Jacques Boghen, and Jean Hérenguel.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 251, no. 23, Dec. 5, 1960, p. 2698-2700.

h • i • j • k •

A Theory of Order-Disorder Phenomena I. II. A moment method due to Kirkwood for the computation of the occupation probabilities of a pair of nearest neighbor sites in an order-disorder system is generalized in a systematic way to larger figures of sites in the lattice. In this paper, the general theory is given and formal expressions for the moments are derived. The method of Guggenheim and McGlashan, Yang and Li, and of Kikuchi-Hijmans-De Boer, are rederived by restriction to the first moment. Furthermore, using the second- and third-moment, explicit expressions for the semi-invariants $\lambda_{21}{}^{L}$ and $\lambda_{31}{}^{L}$ are given for the case that the interaction is restricted to pairs of nearest neighbors. ***F. E. J. Kruseman Aretz and E. G. D. Cohen.*** *Physica*, v. 26, Nov. 1960, p. 967-996.

Arrangement of Dislocations in Iron. The arrangement of the dislocations has been studied in Fe in various conditions, namely annealed, cold-worked, recovered and after creep. In all conditions, the dislocation network is characterized by attractive intersections where two dislocations join to make one dislocation, and there is convincing evidence for the idea that at many of these intersections two $\frac{1}{2}a\langle 111\rangle$ dislocations join to make one $a\langle 100\rangle$ dislocation. These attractive intersections are thought to contribute substantially to the flow stress. There are also repulsive intersections but according to calculation they constitute weaker obstacles to flow than the attractive junctions. ***W. Carrington, K. F. Hale, and D. McLean.*** *Royal Society, Proceedings*, v. 259, ser. A, Dec. 6, 1960, p. 203-227 + 5 plates.

Analytical Methods in the Beryllium Program. Methods are discussed for determining the purity of the metal. ***J. M. Googin.*** *U. S. Atomic Energy Commission*, Y-1324, Dec. 13, 1960, 12 pp. (UF767 Un3.1y Contin.)

* **Investigation of the Intermetallic Fe-Al Composition by the Calorimetric Method.** The temperature dependence of the thermal capacity of two Fe-Al alloys near the stoichiometric composition (1:1) after different thermal treatment was studied. The two alloys between 600 and 800 C are subjected to considerable disturbance, which corroborates the assumption that at 800 C the alloys with 66.6 weight % Fe exhibit a complete disorder. (*In Russian.*) Issledovanie intermetallicheskogo soedineniia FeAl kalorimetricheskim metodom. ***V. A. Troshkina and K. G. Khomiakov.*** *Moscow, Universitet, Vestnik, Seriia II, Khimiia*, v. 15, no. 5, Sept.-Oct. 1960, p. 47-50.

* **Microstructures and Notes on Carbon Steels to B.S. 3100: 1957: 592 Grade C.** Faster cooling rates gave finer ferrite grain size, and smaller pearlite colonies having a finer lamellar spacing. Normalizing showed an increasing yield strength, yield ratio, ultimate tensile strength, Brinell hardness, and Izod and a decreased elongation and reduction in area. ***J. Turton and B. H. C. Waters.*** *British Foundryman*, v. 53, Nov. 1960, p. 480-482.

* **Gases in Ferroalloys.** A method was described for the determination of the gaseous elements contained in ferroalloys; the test material was decomposed at three temperatures. The effect of the grain size of the sample on the gas content of ferrosilicon, calcium silicon and alcasil 20 and the effects of storage in the air were determined. (*In German.*) Gase in Ferrolegierungen. ***Roger Limpach and Borut Marincek.*** *Archiv für das Eisenhüttenwesen*, v. 31, no. 11, Nov. 1960, p. 639-643.

Soft X-Ray Emission From Potassium Metal in the 40-1000 Å Range. The emission has been examined using the grazing incidence photon counting spectrometer. An energy level scheme for solid K in emission has been constructed. A note regarding the energy of the L_1 level in Na, Mg, and Al is appended. ***R. S. Crisp.*** *Philosophical Magazine*, v. 5, ser. 8, Nov. 1960, p. 1161-1169.

Movement of Point Defects During Fatigue of Aluminium Crystals. The dynamic stress-strain behavior of Al crystals fatigued in a push-pull machine at 13 cycles/second is outlined. ***E. Roberts and R. W. K. Honeycombe.*** *Philosophical Magazine*, v. 5, ser. 8, Nov. 1960, p. 1147-1149.

A Magnetic Study of Precipitation in a Gold-Cobalt Alloy. The precipitation kinetics have been followed by measuring the saturation magnetization of the precipitated Co and the results are compared with current theories. The remanent magnetization, coercive force and field to reduce remanence to zero of aged specimens have been measured and the results

are discussed in terms of the single magnetic domain model. ***P. Gaunt.*** *Philosophical Magazine*, v. 5, ser. 8, Nov. 1960, p. 1127-1145.

X-Ray Evidence for Segregation of Solute to Stacking Faults in a Copper-Aluminium Alloy. The intensity of scattering of monochromatic X-rays at small angles from a Cu-base solid solution containing 15 wt.% Al increased after heating at 150-250 C, a temperature range in which the alloy hardens, and there is little or no recrystallization. This increase is attributed to segregation of Al to the ribbons of stacking fault between partial dislocations. ***R. W. Cahn and R. G. Davies.*** *Philosophical Magazine*, v. 5, ser. 8, Nov. 1960, p. 1119-1126.

METALS—POWDER

Some Developments in Metal Powder Presses. The requirements of presses for the production of parts from metal powder are listed. The historical development of modern presses from the early adaptations is described, their features being related to the demand for large and more complex shapes and the use of powders that are not easily formed. Reference is made to the difference in approach shown in the American multi-motion presses and the Continental combination of simple presses with complex tools used as a sub-press assembly. ***J. Oakley.*** *Powder Metallurgy*, no. 6, 1960, p. 1-19.

Some Fundamental Studies in the Cold Compaction of Plastically Deforming Solids. Studies were made of the behavior under compression of materials which exhibit plastic deformation at normal temperatures, as exemplified by In and Pb. Attention was focused on the effects of die-wall friction and on the influence of the relative volume. The die-wall friction effects produced by a solid plug of the material were compared with those produced by a particulate fill of the same material when compressed under similar conditions, and a correlation of these effects with the shear strength of the material was made. A theoretical equation relating relative volume at either end of the compact is suggested. ***D. Train and J. A. Hersey.*** *Powder Metallurgy*, no. 6, 1960, p. 20-35.

Determination of Hoop Stresses Induced in a Cylindrical Steel Die by Compacting Metal Powders. True die stresses existing in a hardened steel die during the compacting of various lubricated and non-lubricated powders were measured by mounting strain-gages on the periphery of the die at numerous points along its length. Values of the hoop stress varied from approximately 0.05 to 0.40 of the calculated and measured hydraulic fluid stress. For a particular metal powder, the stress was a function of the average particle size, the powder height, and the amount of lubrication. ***S. J. Bustamante and H. Sheinberg.*** *Powder Metallurgy*, no. 6, 1960, p. 36-51.

* **Contribution to the Problems of Iron Powder Production in Czechoslovakia.** Recommends direct reduction of pure ores or of other sufficiently pure iron oxides into an iron sponge (from which the iron powder can be prepared by pulverizing), spraying of melted metal by compressed air (for powder metallurgy), or by pressurized water (for welding electrodes). (*In Czech.*) K problémům výroby železného prášku ČSSR. ***Miroslav Petrdlík.*** *Hutnické Listy*, v. 15, no. 11, Nov. 1960, p. 857-860.

* **Manufacture of Titanium Strips by Powder Rolling.** The sintering temperature of the strip was 500 C lower than the temperature used in sintering bars, and 800 C lower than the temperature used in melting ingots in vacuum furnaces. The yield of finished strip from the original amount of powder was of the order of 85 to 90%. (*In Russian.*) Poluchenie titanovoi lenty putem prokatki poroshkov. ***V. K. Gavrilova, G. M. Karpman, and V. G. Khromov.*** *Tsvetnye Metally*, v. 33, no. 11, Nov. 1960, p. 69-76.

Slip Casting: A Good Way to Shape Difficult Materials. Discussion encouraging application of slip casting for design problems complicated by very complex shapes, brittle, hard-to-machine metals, etc. ***L. M. Schifferli, Jr.*** *Materials in Design Engineering*, v. 52, no. 7, Dec. 1960, p. 108-109.

Attempts at Producing Synthetic Composite Alloys. The effect of compacting pressure, sintering temperature and sintering time on compound alloys of the low-melting metals Sn, Mg, Zn, Pd, Cd, and Bi with WC and TiC is investigated on the basis of density values. ***D. E. Gücer.*** *Planseeberichte für Pulvermetallurgie*, v. 8, no. 3, Dec. 1960, p. 119-121.

Stress Infiltration of Two-Phase Alloys. By letting an infiltrated molten metal freeze from all surfaces of a specimen, a tension or a compression occurs which is due to the shrinkage or expansion in freezing. ***G. Matsumura.*** *Planseeberichte für Pulvermetallurgie*, v. 8, no. 3, Dec. 1960, p. 110-118.

Relationships Between Thermovoltage and Sintering. Description of an equipment for developing thermovoltages by sintering in a temperature-gradient. The change of the voltage during sintering of a 50-50 mixture of Cu-Ni powders gives a good picture of the progress of the reaction: Cu + Ni→(Cu, Ni)-solid solution. From the values of the isothermal voltages measured at various temperatures as a function of time, the energy of activation for this sintering process was calculated to be 16,000 cal/mole. (*In German.*) Zusammenhänge zwischen Thermospannung und Sintervorgang. ***G. Ritzau.*** *Planseeberichte für Pulvermetallurgie*, v. 8, no. 3, Dec. 1960, p. 100-109.

The Displacement of Gas From Powders During Compaction. A soap-bubble method was used to observe in detail the flow of gas out of powder masses during and immediately after compaction. The effects of powder material and size distribution, die size, pressing speed, and degree of compaction were investigated. The amount of gas trapped in the compact at completion of pressing varied from 12 to 83% of the initial amount of gas present in the spaces between the powder particles, over the range of compaction conditions studied. As expected, the amount trapped increased with increase in die size, with increase in pressing speed, and with decrease in particle size. Very little gas escaped during the later stages of compaction, even at slow pressing speeds. The effect of a small punch/die clearance was examined in typical cases, and shown to be minor, except with a coarse powder pressed at a high speed. That trapped gas can produce cracks was demonstrated by making compacts containing varying amounts of trapped gas, other conditions remaining constant. With the particular powder used, once the amount of trapped gas had passed a certain level, the compacts tended to be fairly badly cracked. It appears, however, that cracks due to gas pressure alone tend to occur only when powders are rapidly compacted at very high densities. ***W. M. Long and J. R. Alderton.*** *Powder Metallurgy*, no. 6, 1960, p. 52-72.

Radial Pressures in Powder Compaction. A simple theory is advanced to explain the variation of radial (die-wall) pressure during compaction in conventional dies. The theory predicts that, during the application and release of pressure by the punch, the radical pressure should follow a characteristic cycle whose form is determined by the elastic properties and by the yield stress in shear of the material being pressed. An apparatus for the measurement of radial pressures and powder/die friction coefficients at moderately high temperatures is described. ***W. M. Long.*** *Powder Metallurgy*, no. 6, 1960, p. 73-86.

The Influence of Tooling Methods on the Density Distribution in Complex Metal-Powder Parts. The theoretical movements required for the various moving tool elements during the pressing cycle are examined for several typical component sections. These theoretical movements are then compared with the actual movements of the moving tool elements in various types of tooling. The conclusion is reached that the conventional tool designs vary greatly from the ideal in many ways, permitting uncontrolled lateral powder movement during pressing and causing excessive density variation in the pressed compact. Three major problems are apparent: The use of a solid die for pressing compacts with varying section thicknesses results in an "average" die movement that is always too great for the thicker section and too small for the thinner section. The double function of the floating punch, which takes vertical pressure on its horizontal face while its vertical face acts as a die, presents a very difficult problem. The floating punch movement, controlled by its horizontal face, is always greater than the correct movement required to give minimum density variation in the portion of the compact formed by the vertical surface of the punch. The various types of support used for floating punches rarely provide the correct timing, sufficient maximum load, or progressively increasing resistance essential to ensure equal density distribution within the powder during the pressing operation. Suggestions for tooling, designed to solve some of these problems, are discussed. ***H. G. Taylor.*** *Powder Metallurgy*, no. 6, 1960, p. 87-124.

The Compacting of Metal Powders by Explosives. A technique developed for compacting metal powders by the use of detonating explosives under controlled conditions is described. Aluminium, iron, copper, and steel powders were originally compacted by this means into solid cylinders. Graphite and other non-metal powders have recently been compacted, and modifications have been introduced whereby annular cylinders may be formed. This novel technique may find application in cases where existing mechanical methods of powder compacting are not adequate. ***W. T. Montgomery and H. Thomas.*** *Powder Metallurgy*, no. 6, 1960, p. 125-128.

Beryllium Chip Processing. A process was developed for upgrading Be chips contaminated with cutting oils, metallic and nonmetallic trash. Investigations were conducted on grinding of these chips to mesh sizes as low as −200 mesh utilizing attrition milling, fluid energy milling, or planetary ball milling. This entire process adds no significant impurities other than O. The beryllium oxide content of the powders increases no more than 0.50% over that present in the original chip. ***Z. L. Ardary, et al.*** *U. S. Atomic Energy Commission*, Y-1328, Dec. 15, 1960, 44 pp. (UF767 Un3.1y Contin.)

Sintered Stainless Steel Powders. II. Effects of powder characteristics and processing variables on properties of sintered compacts. ***R. L. Sands and J. F. Watkinson.*** *Precision Metal Molding*, v. 19, Jan. 1961, p. 46-48.

* **Specific Electric Resistance as a Unit of Measurement of the Degree of Sintering.** Sinters of two kinds of powder were used: electrolytic Fe, grain size <0.063 mm, and electrolytic Cu, grain size <0.063 mm. Sintering was performed in a purified H atmosphere between 100-1200 C for Fe and 100-950 C for Cu. (*In Rumanian.*) Rezistivitatea electrică, măsură a gradului de sinterizare. ***Georgeta Dan, Aurelia Protopopescu, and Olga Ivanciu.*** *Academia Republicii Populare Romine, Centrul de Cercetări Metalurgice, Studii şi Cercetări de Metalurgie*, v. 5, no. 3, 1960, p. 343-364 + 2 plates.

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

* **The Quality Control Program Behind Ford's Extended Warranties for 1961.** Ford's advanced quality control is a broad-gaged system that assures quality in the product. The company has emphasized in-process inspection and supplier quality assurance. ***Laurence W. Collins, Jr.*** *Machinery (New York)*, v. 67, no. 5, Jan. 1961, p. 89 + 7 pages.

* **Magnetic Particle Inspection Pays Off.** A reduction in over-all cost of operations, plus an increase in the safety factor on drilling masts, tools, subs and drill pipe threads and related equipment has been attained by numerous oil companies and contractors since their adoption of routine magnetic particle inspection as a preventive maintenance tool. ***Walter A. Henkes.*** *World Oil*, v. 152, Jan. 1961, p. 94-96.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

* **The Control and Instrumentation of a Marine Reactor.** Outlines the nature of the problem and describes the fundamental reactor characteristics which must be taken into account, and the basic mathematical equations used in designing a reactor control system. It points the way to possible solutions in particular cases and gives a general description of a typical control and instrumentation system which might be used in a ship. ***R. Anscomb and F. Hutber.*** *Joint Nuclear Marine Propulsion Panel, Journal*, v. 4, no. 2, Oct. 1960, p. 71-93.

Negative-Reactivity Measurements. Negative-reactivity measurements are frequently made by the rod-drop and source-jerk techniques. Analysis of the data from such experiments by the usual methods requires measurement of the flux-time curve during a transient. Two alternative methods of obtaining negative reactivities are presented here. Neither of these methods requires measurement of a flux transient. Experimental results using these methods are given. ***William S. Hogan.*** *Nuclear Science and Engineering*, v. 8, Dec. 1960, p. 518-522.

* **A New Isotope: Cadmium-103.** A new activity, produced by 160 MeV O^{16} bombardments of thick molybdenum oxide targets, is assigned to Cd^{103} on the basis of chemistry and its decay to Ag^{103}. The isotope Cd^{103} has a half-life of 10±1.5 min and decays by positon emission accompanied by 0.22, 0.62 and 0.85 MeV γ-rays. ***Ivor L. Preiss, Peder J. Estrup, and Richard Wolfgang.*** *Nuclear Physics*, v. 18, no. 4, Sept. 1960, p. 624-627.

A 200-Mw(e) Boiler-Superheater Reactor Preliminary Design. An introduction and summary are presented. Mechanical design, nuclear design, thermal and hydraulic design, and reactor auxiliary systems are discussed. *U. S. Atomic Energy Commission, GNEC* 136, Oct. 25, 1960, 127 pp. + 43 figures. (UF767 Un3.1gn Contin.)

Processes Involved in Electromagnetic Acceleration of Particles to Cosmic-Ray Energies. Extends ideas according to which charged particles could be accelerated to cosmic-ray energies through electromagnetic induction resulting from magnetic fields like those encountered in sunspots. ***W. F. G. Swann.*** *Franklin Institute, Journal*, v. 270, no. 5, Nov. 1960, p. 343-352.

The Energy Levels of ^{24}Mg and ^{32}S. The energy levels of ^{24}Mg and ^{32}S have been determined from studies of the ^{23}Na (^{3}He, d)^{24}Mg and the ^{31}P(^{3}He, d)^{32}S reactions. In both cases ^{3}He particles of up to 10.2 Mev were used and the deuteron energy spectra were measured with a broad-range magnetic spectrograph. Thirty-nine states were observed in ^{24}Mg below an excitation energy of 11.861 Mev and twenty-four in ^{32}S below 8.496 Mev. ***S. Hinds and R. Middleton.*** *Physical Society, Proceedings*, v. 76, pt. 4, Oct. 1960, p. 553-558.

* **On a Unified Description of Elementary Particles.** A scheme of approach to the unified description of elementary particles is proposed by using the "neutrino" and the concept of "charge-on". The electron and muon are considered as two kinds of electrically (e-) charged-on neutrino, and the proton, neutron and Λ-particle are baryonically (b-) charged-on neutrino, electron and muon, respectively. ***Mituo Taketani and Yasuhisa Katayama.*** *Progress of Theoretical Physics*, v. 24, no. 3, Sept. 1960, p. 661-678.

* **The Theory of the Nucleon Level Structure in Terms of the Pion-Pion Resonance. I.** The existence of sharp pion-pion resonance is assumed for the $T=j=1$ state at about 600 Mev. This resonance state is approximately replaced by a real $T=j=1$ particle $\rho^{\pm,0}$ and its interactions with the pion field and the electromagnetic field are determined. The calculation of pion-nucleon scatterings through ρN intermediate states shows in the Born approximation that very strong attractive forces seem to exist for both $T=\frac{1}{2}$, $d_{3/2}$ and $T=\frac{1}{2}$, $f_{5/2}$ pion-nucleon states at about the p-production threshold energy. ***Kiyomi Itabashi, Masaaki Kato, Kimiko Nakagawa, and Gyo Takeda.*** *Progress of Theoretical Physics*, v. 24, no. 3, Sept. 1960, p. 529-554.

(d, α) Reactions on Some Light Nuclei. The intensity of the transition to the 2.31 Mev ($T = 1$) state of N^{14} was measured in the range from 10.5 to 11.4 Mev in steps of 100 keV intervals with Al absorber. The α particles from the targets were detected by a thin CsI(Tl) crystal scintillation spectrometer. ***Chuin Hu.*** *Physical Society of Japan, Journal*, v. 15, Oct. 1960, p. 1741-1752.

* **On the Standardization of Radioisotopes.** The principles are outlined for counting with 4π or gas-filled counters, the use of 4π-counters for internal gas activity measurements, and the coincidence technique. The standardization of electron capture nucleides and some special ways of standardization are mentioned. A table of an international comparison of Iodine-131 in October 1959 is included. (*In Swedish.*) Om standardisering av radioaktiva isotoper. ***Sten Hellström.*** *TVF, Teknisk-Vetenskaplig Forskning*, v. 31, no. 6, 1960, p. 255-263.

On the Stripping of Two Nucleons. Formulae are obtained for the differential cross sections of the ^{3}He, p), (t, p) and (d, α) reactions in which the structure of the projectile and captured nucleons is taken into account. The relationship of these formulae to the results of earlier theories in which the structure is neglected is considered. The application of the theory to the interpretation of experimental results is discussed. ***H. C. Newns.*** *Physical Society, Proceedings*, v. 76, pt. 4, Oct. 1960, p. 489-496.

Singly Scattered Delayed Electrons in Extensive Cosmic Ray Air Showers. On the basis of population density and delay distribution, the majority of the delayed particles detected by Jelley and Whitehouse associated with extensive air showers are shown not to be singly scattered shower electrons. The mean delay of such electrons is 2 x 10^{-5} sec contrasting with the previously measured value of 14 x 10^{-5} sec. The detected delayed particles are probably μ-mesons. ***P. J. Eccles.*** *Physical Society, Proceedings*, v. 76, pt. 4, Oct. 1960, p. 449-457.

A Study of the ^{27}Al(^{3}He, d)^{28}Si Reaction. The energy levels of ^{28}Si have been determined below an excitation energy of 10.37 Mev by magnetic analysis of the deuterons from the ^{27}Al(^{3}He, d)^{28}Si reaction. Angular distributions of several deuteron groups have been measured at incident energies of 5.7 and 9.16 Mev and from a comparison with stripping theory, certain l-value assignments have been made. Evidence is presented favoring the 9.314 and 9.379 Mev levels, being respectively the first and second $T = 1$ states of ^{28}Si. ***S. Hinds and R. Middleton.*** *Physical Society, Proceedings*, v. 76, pt. 4, Oct. 1960, p. 545-552.

The Spin-Orbit Potential in Proton-Proton Scattering. An extension of the potential model for p-p scattering to relativistic energies is proposed. The treatment is based on a truncated two-particle Dirac equation, from which an approximate, semi-relativistic wave equation is derived by reduction to large components. Using a potential related to that of Gammel and Thaler, numerical calculations of p-p scattering at 635 and 1000 Mev have been carried out. ***D. W. L. Sprung and J. B. Willis.*** *Physical Society, Proceedings*, v. 76, pt. 4, Oct. 1960, p. 539-544.

* **Two Quanta Transitions on Ba^{137}.** According to second-order perturbation theory, transitions in nuclear isomers should occur for which two quanta are emitted with arbitrarily divided energies. The transition probability for such a process has been calculated for Ba^{137m} for various multipole transition combinations. The dependence of transition probability upon energy for electric multipole transitions differs from that for magnetic. (*In German.*) Über Zweiquanten-Übergänge an Ba^{137}. ***W. Beusch.*** *Helvetica Physica Acta*, v. 33, no. 5, 1960, p. 363-394.

* **γ-γ-Correlation Measurements on ^{152}Sm, ^{152}Gd and ^{154}Gd: The Spin Sequence, the Ratio of Mixing and the g-Factor.** Angular correlation methods were used to establish the spin sequence and the multipole mixing ratio of several γ-ray cascades in the decay of ^{152}Eu, ^{152m}Eu, and ^{154}Eu, and to measure the nuclear g-factor of ^{152}Sm. For liquid sources, only the 123 keV level of ^{154}Gd showed attenuation. It was found that each level in the decay of ^{152}Eu to ^{152}Sm corresponds to a level of the same spin and parity in the decay of ^{154}Eu to ^{154}Gd. In Gd^{154}, an additional 2 level of 1721 keV exists, which decays by $E1$ radiation to the 2^+, $K = 2$ and the 2^+, $K = 0$ levels. The g-factor of the first rotational state of ^{152}Sm was measured, using liquid and polycrystalline sources. (*In German.*) γ-γ-Korrelationsmessungen an ^{152}Sm, ^{152}Gd und ^{154}Gd Spinzuordnung, Mischungsverhältnis und g-Faktor. ***P. Debrunner and W. Kündig.*** *Helvetica Physica Acta*, v. 33, no. 5, 1960, p. 395-428.

Proceedings of the Conference on Transfer Function Measurements and Reactor Stability Analysis Held at Argonne National Laboratory Argonne, Illinois, May 2-3, 1960. Reactor transfer functions, transfer function representation of nuclear power plants, power-void transfer function measurements, combined reactor and power system analysis, methods of investigating noisy power reactors, measurement and analysis of the KEWB transfer function, EBWR stability analyses, high- and low-power SPERT I transfer function measurements, oscillator tests in British fast reactors, and other problems are discussed. *U. S. Atomic Energy Commission, ANL-6205*, May 2-3, 1960, 332 pages. (UF767 Un3.1an Contin.)

Plastics for Atom Smashers. A high-energy nuclear accelerator, together with its supporting apparatus, is a group of highly complex instruments which present unusual materials selection problems. The parts shown illustrate why plastics have played an indispensable role in the design of today's powerful atom smashers. ***James O. Turner.*** *Materials in Design Engineering*, v. 52, no. 5, Nov. 1960, p. 132-133.

* **How GE's APED Cut Contaminated Waste Disposal by 75%.** A specially designed incinerator equipped with spray cooling, and an absolute filtration system, reduced the cost of disposing wastes from the plant's atomic fuel manufacturing operations by 75%. A schematic diagram of the electrical control and alarm system is given. *Plant*, v. 22, Nov. 1960, p. 26-27.

Capsule Cure for Atomic Power Ills. Particles of UO_2 coated with an impermeable layer of alumina are projected as nuclear fuel. Because this form of nuclear fuel does not emit dangerous fission products, even at high reaction temperatures, it may hold the key to safe use of atomic-power generators. *Chemical Week*, v. 87, no. 19, Nov. 5, 1960, p. 59 + 2 pages.

Asymmetry in the Elastic Scattering of Polarized Protons by Deuterium. Asymmetries in the above have been measured at 419 Mev at proton center-of-mass angles from 47.9° to 115°. Suggests that, using the impulse approximation, the results may serve as a test of nucleon-nucleon scattering phase shifts or, with proton-proton scattering data, may be used to obtain $l = 0$ nucleon-nucleon phase shifts. ***Stewart M. Marcowitz.*** *Physical Review*, v. 120, 2nd ser., no. 3, Nov. 1, 1960, p. 891-900.

New Thermoluminescent Dosimeter. A thermoluminescent phosphor (CaF_2:Mn) is mounted on an electrically heatable support in an evacuated or gas-filled envelope. Will detect gamma radiation doses in the milliroentgen range. ***James H. Schulman, Frank H. Attix, Edward J. West, and Robert J. Ginther.*** *Review of Scientific Instruments*, v. 31, Dec. 1960, p. 1263-1269.

* **The Problem of Increase of Internal Friction in Uranium During the Process of Change of Its Temperature.** A semiquantitative rating of the dependence of the increase of the internal friction on the velocity of the heating and the frequency and amplitude of the vibrations was carried out. The results are in agreement with the experimental data. The effect of the initial condition of the sample on the increase of the internal friction at the first stages of heating was investigated. (*In Russian.*) K voprosu ob uvelichenii vnutrennego treniia v urane v protsesse izmeneniia ego temperatury. ***Iu. N. Sokurskii and Iu. V. Bobkov.*** *Atomnaia Energiia*, v. 9, no. 5, Nov. 1960, p. 392-398.

* **Obtaining of Thick Films of Thorium, Uranium, Neptunium, Plutonium, Americium.** The electrolytic method, the mechanical application with additions of organic substances, the electrochemical method, and the method of precipitation from suspensions are discussed. (*In Russian.*) Poluchenie tolstykh sloev toriia, urana, neptuniia, plutoniia, ameritsiia. ***G. I. Khlebnikov and E. P. Dergunov.*** *Atomnaia Energiia*, v. 9, no. 5, Nov. 1960, p. 406-408.

* **An Installation for the Investigation of the Effect of γ-Radiation on Semiconductive Materials.** A Co installation in the Physico-Technical Institute of the Academy of Science of the USSR is described, which is used to investigate the γ-radiation effect on electric properties of semiconductors. (*In Russian.*) Ustanovka dlia issledovaniia deĭstviia γ-izlucheniia na poluprovodnikovye materialy. ***B. M. Konovalenko, S. M. Ryvkin, I. D. Iaroshetskii, and L. P. Bogomazov.*** *Atomnaia Energiia*, v. 9, no. 5, Nov. 1960, p. 408-409.

* **Uranium Mono-Carbide.** Uranium monocarbide is of interest as a possible nuclear fuel and as a material for nuclear thermoelectric transformers. The conditions of caking and of hot compression of UC powder and also the conditions of caking of UC + U alloys, which allows the preparation of samples of a porosity of about 5%, were investigated. The sp. gr. of the UC powder, determined by the pycnometer, was 12.97 ± 0.09 g/cm³. UC samples treated by cyclic heat in the range of 200-1000 C were stable without any decomposition for 500 cycles. UC + U samples were stable for more than 1000 cycles. (*In Russian.*) Monokarbid urana. ***G. A. Meerson, R. B. Kotel'nikov, and S. N. Bashlykov.*** *Atomnaia Energiia*, v. 9, no. 5, Nov. 1960, p. 387-391.

Measurement of Time Intervals for Time Correlated Radioactive Decay. The measurements shows that the classical Marsden-Barratt law does not apply to this case of time correlated decay. They seem, however, to be in agreement with the theory of Lindeman-Rosen, taking into account that the counter receives only the radiation emitted in a solid angle near to 2π. ***H. Lindeman, E. Mornel, and U. Galil.*** *Physica*, v. 26, Nov. 1960, p. 961-966.

Inertial Moment of Large Many-Fermion Systems With Repulsive Interactions. The interaction effects on the moment of inertia of a large many-body fermion system moving under periodic boundary conditions have been explicitly derived in the second order of particle-particle coupling for the cause of nonsingular repulsive interparticle forces. The derivation is facilitated by the use of a new Hamiltonian constructed by canonical transformation. A graphical analysis is presented. ***Ronald M. Rockmore.*** *Physical Review*, v. 120, 2nd ser., no. 6, Dec. 15, 1960, p. 1933-1942.

Evaporation of Charged Particles From Highly Excited Compound Nuclei. Energy spectra and angular distributions of alpha particles and protons emitted in the bombardment of Ni targets with 160-Mev O ions were measured. At all energies, there is some excess of particles in the forward direction and at high energies the distributions are predominantly forward peaked. ***W. J. Knox, A. R. Quinton, and C. E. Anderson.*** *Physical Review*, v. 120, 2nd ser., no. 6, Dec. 15, 1960, p. 2120-2128.

Second-Difference Analysis of Bremsstrahlung Yield Curves. The second-difference weighting function of the bremsstrahlung spectrum obtained from an empirical isochromat at 15.1 Mev and corrected for thick-target effects is shown to behave like a delta function of width approximately equal to the energy interval in analysis. This behavior greatly simplifies cross-section analysis of bremsstrahlung-induced activation curves when resonance phenomena are present. ***K. N. Geller.*** *Physical Review*, v. 120, 2nd ser., no. 6, Dec. 15, 1960, p. 2147-2149.

Neutron-Proton Polarization and Differential Cross Section at 128 Mev. A 42% polarized neutron beam of 128 Mev average energy has been used to measure the *n-p* differential cross section and polarization. A range telescope detected recoil protons from a liquid H target placed in the beam. Obtained values are given. ***Russell K. Hobbie and Douglas Miller.*** *Physical Review*, v. 120, 2nd ser., no. 6, Dec. 15, 1960, p. 2201-2206.

Slow Neutron Resonance Spectroscopy. II. Ag, Au, Ta. The results of time-of-flight measurements of Ag, Au, and Ta resonance parameters are presented. Neutron widths are given for 79 levels in Ag to 728 ev, 55 levels in Au to 940 ev, and 62 levels in Ta to 330 ev. Radiation widths for many of the stronger levels, and in some cases resonance J values are obtained. The reduced neutron width distributions are in good agreement with Porter-Thomas distributions for Au and Ta. ***J. S. Desjardins, J. L. Rosen, W. W. Havens, Jr., and J. Rainwater.*** *Physical Review*, v. 120, 2nd ser., no. 6, Dec. 15, 1960, p. 2214-2226.

Electron Microscope Observations of Fission Fragment Tracks in Thin Films of UO_2. Electron microscope studies of the tracks produced by fission fragments in thin films of UO_2 have established a 100% detection efficiency for fission events in films 100 A or less in thickness. A background texture decreases the efficiency in thicker films. The tracks register in the films primarily as a result of a redistribution of surface material arising from the disturbance produced by the continuous loss of energy of the fragment by electron excitation and ionization. ***T. S. Noggle and J. O. Stiegler.*** *Journal of Applied Physics*, v. 31, Dec. 1960, p. 2199-2208.

* **The Mass Spectrum of Uncharged Particles During the Electron Bombardment of Molecules.** When molecules are bombarded in an evacuated gas chamber with electrons (200 eV), ionized and neutral particles are obtained. The neutral fragments can be ionized by means of a second electron impact and mass-spectroscopically determined. A study was made of the hydrocarbons propane and hexane. With propane an almost complete qualitative and quantitative analysis of the neutral disintegration products is possible. (*In German.*) Das Massenspektrum der ungeladenen Bruchstücke bei Elektronenbeschuss von Molekülen. ***D. Beck and O. Osberghaus.*** *Zeitschrift für Physik*, v. 160, no. 4, 1960, p. 406-419.

* **The Scattering of Alpha Particles and Deuterons by Iodine-127.** The differential elastic scattering cross sections of 38 MeV α-particles as well as 8 and 19.5 MeV deuterons by I^{127} have been determined using nuclear emulsions. The angular distributions obtained have been analyzed according to Porter's model of absorption along classical undistorted Coulomb orbits. Information is thus obtained on the mean free path of the incident particles in nuclear matter. In the course of this experimental work, indications of the existence of a Cohen peak in the inelastic scattering have been observed; the evidence will be described and the implications discussed. ***I. J. Van Heerden and D. J. Prowse.*** *Nuclear Physics*, v. 19, no. 6, Dec. 1960, p. 589-603.

* **Energy Levels in Chromium Isotopes.** A magnetic spectrograph with photographic detection is used to study the proton groups emitted from the deuteron interaction with a thin Cr target. Applying deuterons of energy 8.67 MeV, nine well-defined proton groups attributed to the isotope 52 of Cr yield Q-values of 5.73, 5.16, 4.72, 3.41, 3.04, 2.11, 1.60, 1.50 and 1.09 MeV with errors of ±0.02 MeV. Four weak groups of protons having Q-values of 6.68, 6.26, 4.89 and 4.46 MeV with errors of ±0.03 MeV may belong to the $Cr^{53}(d, p)Cr^{54}$ reaction. In view of the present energy levels in Cr^{53} and Cr^{54}, interpretation of some gamma-ray groups emitted from previous work on neutron capture of Cr is given. ***F. A. El Bedewi and S. Tadros.*** *Nuclear Physics*, v. 19, no. 6, Dec. 1960, p. 604-613.

* **Energy Levels of Re^{187}.** The gamma rays of Re^{187} following beta decay of the 24-hr W^{187} have been studied using prompt and delayed coincidence techniques. A total of 25 gamma rays was found. Relative intensities are given for the gamma transitions. The directional correlation of the 552-keV-134-keV cascade has been measured. A decay scheme is proposed on the basis of the coincidence measurements. Spins and parities of the principal levels are discussed. ***R. G. Arns and M. L. Wiedenbeck.*** *Nuclear Physics*, v. 19, no. 6, Dec. 1960, p. 634-653.

* **Improved Focussing Near the Cyclotron Source.** The vertical focusing of a cyclotron beam near the ion source was experimentally investigated as a function of the phase of the beam relative to the dee voltage. Considerable improvement in the vertical focusing of the beam was obtained by offsetting the ion source and puller by 20° to the dee edge, and thus retarding by 20° the phase of the first turn. ***W. I. B. Smith.*** *Nuclear Instruments and Methods*, v. 9, Oct. 1960, p. 49-54.

* **A New Type of Čerenkov Detector for the Accurate Measurement of Particle Velocity and Direction.** A new type of Čerenkov radiation detector is proposed, in which the light emitted by a single particle traversing a radiator is imaged, by means of a lens or mirror focused at infinity, on the cathode of an image-intensifier tube. The image is a ring, whose diameter measures accurately the Čerenkov cone angle, and thus the particle velocity. ***Arthur Roberts.*** *Nuclear Instruments and Methods*, v. 9, Oct. 1960, p. 55-66.

* **Apparatus and Analysis for Sum-Coincidence (n, γ) Spectrometer.** Apparatus is described for analyzing two-step cascades of neutron capture γ rays by the sum-coincidence method and consideration is given to the types of results which can be obtained. A detailed analysis is given of detection efficiency and peak shapes and their dependence on the characteristics of the sum discriminator. Several background effects are analyzed quantitatively such as back-scattering between scintillators, annihilation photon transfer between scintillators, cascades which terminate only near to the ground state, three-photon cascades and uncertainties caused by unknown angular correlations. ***J. E. Draper and A. A. Fleischer.*** *Nuclear Instruments and Methods*, v. 9, Oct. 1960, p. 67-77.

* **The Correction of Resonance Peaks for Experimental Resolution.** A technique is discussed for the determination of the true resonance shape from a measured resonance shape when the apparatus resolution shape is known, or, conversely, the determination of the resolution function if the true resonance shape is known. The problem is essentially that of the solution of an integral equation of the first kind and use is made of the relations among the Fourier coefficients to determine the unknown function. A successful application is made to the case of a resonance in the total neutron cross section of carbon where the widths of the resonance and resolution function are comparable. Some of the limitations of the technique are discussed. ***R. O. Lane, N. F. Morehouse, Jr., and D. L. Phillips.*** *Nuclear Instruments and Methods*, v. 9, Oct. 1960, p. 87-91.

* **A Semi-Automatic Analyser for Bubble Chamber Photographs.** Photographs of nuclear particle tracks can be accumulated rapidly with fast-cycling bubble chambers. Describes a machine for measuring the photographs quickly so that the subsequent computations can be done with an electronic computer. The films are projected onto a ground glass screen bearing a reference mark, and moved by hand through a pantograph to bring interesting points onto the mark. The pantograph carries a plate with a fine square lattice of dots, and four photocells serve to digitise its X and Y coordinates. The two stereoscopic images of a point can be merged by moving one of the projection lenses; this motion also is digitised photoelectrically. After setting each point, the measured data are punched on tape, to be fed later to an electronic computer. ***O. R. Frisch and A. J. Oxley.*** *Nuclear Instruments and Methods*, v. 9, Oct. 1960, p. 92-96.

* **Corrections for Backscattering and Energy Resolution in Beta Spectroscopy by Scintillation Detectors.** The correction for phosphor backscattering and energy resolution is applied to plastic detectors. The application of the correction terms to the β spectra of Tl^{204} and Tm^{170} gives satisfactory results. ***G. Bertolini, F. Cappellani, and A. Rota.*** *Nuclear Instruments and Methods*, v. 9, Oct. 1960, p. 107-110.

* **A Differential Beam Collector.** A double faraday cup was built, which can measure the energy of a beam of charged particles by determining their mean range, and which can simultaneously be used to integrate the current of the beam. ***W. T. H. Van Oers.*** *Nuclear Instruments and Methods*, v. 9, Oct. 1960, p. 111-112.

* **Automatic Mass Number Determination for Isotope Separators and Mass Spectrometers.** Automatic mass number determinations for isotope separators and mass spectrometers are possible by means of an electronic computer system. A detailed description of this method, as applied to the isotope separator in Pretoria, is given. ***L. Wåhlin.*** *Nuclear Instruments and Methods*, v. 9, Oct. 1960, p. 21-28.

* **Notes on a Fast Time Analyzer for Short Lifetime Measurements.** A critical comparison of the single- and multichannel method for short lifetime measurements of excited states in nuclei is given. A new time-to-height converting system based on the pulse overlap principle of a biased diode discriminator, was constructed. The time resolution of the prompt γ-γ coincidence curve from a Co^{60} source is 5×10^{-10} sec. The influence of the energy of the coinciding particles on the performance of the time analyzer, and a stability control method are discussed. ***M. Bonitz and E. J. Berlovich.*** *Nuclear Instruments and Methods*, v. 9, Oct. 1960, p. 13-20.

* **A New Type of Neutron Spectrometer.** Neutrons are detected in a small Li^6I (Eu) scintillator placed at the center of polyethylene moderating spheres with sizes ranging from 2 to 12 in. in dia. The counter has excellent energy sensitivity from 0.1 to 2 MeV and is particularly useful for determining the shapes of continuous neutron spectra. The pronounced difference in the efficiencies for the five sizes of spheres which were calibrated provides a basis for accurate neutron energy determination. The good γ ray discrimination of the counter allows it to be used with a radium-beryllium neutron source. ***Richard L. Bramblett, Ronald I. Ewing, and T. W. Bonner.*** *Nuclear Instruments and Methods*, v. 9, Oct. 1960, p. 1-12.

* **Parameters and Gamma-Ray Spectra of Neutron Resonances in the Isotopes of Mercury.** The Argonne fast chopper was used to study the neutron resonances of Hg. The spacings and radiation widths exhibit the expected rapid increase as the doubly closed shell is approached. Unexpectedly, the total radiation widths of different resonances of Hg^{201} are found to fluctuate by a larger factor than has been previously observed in any other nuclear species. The gamma-ray spectra and the multiplicity of gamma rays from capture in these resonances were measured and both quantities were found to differ from resonance to resonance in a way that is consistent with the fluctuations in the widths. ***R. T. Carpenter and L. M. Bollinger.*** *Nuclear Physics*, v. 21, no. 1, Nov. 1960, p. 66-98.

OPERATIONS RESEARCH

*** Individualism vs. the Committee Process.** Like any other management "tool", the problem of committee use in management must be handled carefully and tactfully with a sound appreciation of the fact that it apparently has become a part of the business structure of today. The author subjects the pros and cons to close study, measuring and evaluating authoritative comments and situations. ***Edwin A. Giermak.*** *Advanced Management*, v. 25, Dec. 1960, p. 16-19.

The Age of Massive Engineering. Outlines some of the new problems management practice and theory must face up to. Central problem lies in managing of men—those who provide and apply new knowledge as employees. ***Paul O. Gaddis.*** *Harvard Business Review*, v. 39, no. 1, Jan.-Feb. 1961, p. 138 + 5 pages.

ORE AND MATERIALS BENEFICIATION

Organic Ion Flotation. It is now possible to concentrate organic ions from aqueous solution by adding a surfactant collector of opposite charge and then introducing fine bubbles, floating the insoluble product to the surface where it collects in the froth, or preferably as a scum. ***F. Sebba.*** *Nature* (Suppl.), v. 188, Nov. 26, 1960, p. 736-737.

*** Recovery of Rich Iron Ores by Means of Oil, Gas and Water Vapor Mixtures.** The ores studied contained ~63-67.5% Fe and the temperature of the mixtures was about 850 C. The greater the Fe oxide content (the general Fe content being equal), the lower the water-vapor concentration in the initial water-vapor mixture. For an ore with 46% Fe, the water-vapor concentration was 50% and decreased to 45 and 35% for ores with 63 and 67.5% Fe. (*In Russian.*) Vosstanovlenie bogatykh zheleznykh rud smesiami neftianogo gaza s vodianym parom. ***M. Z. Enikeeva, S. S. Krivolapov, R. D. Obolentsev, and V. P. Rozhdestvenskii.*** *Akademiia Nauk SSSR, Otdelenie Tekhnicheskikh Nauk, Izvestiia, Metallurgiia i Toplivo*, 1960, no. 5, Sept.-Oct., p. 19-24.

Reduction of Powdered Iron Oxide. A Vertical-Flow Reactor. When most of the ferric oxide is reduced to magnetite, a new period occurs, where reduction rate is accelerated. ***W. A. Lloyd and N. R. Amundson.*** *Industrial and Engineering Chemistry*, v. 53, Jan. 1961, p. 19-22.

Reduction of Powdered Iron Oxide. A Tubular Reactor. Complicating factors which result from large particle sizes. ***I. G. Dalla Lana and N. R. Amundson.*** *Industrial and Engineering Chemistry*, v. 53, Jan. 1961, p. 22-26.

*** Flotation Froth Level Detector.** Instrument consists of two units—a detector head, mounted directly above the interface to be monitored, and a control unit which may be placed at some distance from the detector. ***J. H. Pownall and P. L. Palmer.*** *Mining Magazine*, v. 103, no. 6, Dec. 1960, p. 334-335.

*** Production of Fluxed Pellets From Fine Concentrates.** Fluxed pellets from fine magnetite concentrates fired by the Uralmekhanobr method will produce a good iron-ore material for blast- and open-hearth furnaces. ***D. G. Khokhlov.*** *Stal' in English*, 1960, no. 8, Aug., p. 553-557.

*** A Study of the Reduction Processes of Iron Ores With Methane by Fluidization and Cyclone Melting.** Preparatory laboratory tests in the cold were conducted in order to obtain preliminary data concerning the movement of the gas-ore fluid, and in the hot state in order to obtain thermochemical kinetic data. It is possible to produce a carburized molten metal. (*In Rumanian.*) Studiul proceselor de reducere a minereurilor de fier cu metan prin fluidizare şi topire ciclonată. ***P. Dumitraşcu and M. Ispas.*** *Academia Republicii Populare Romine, Centrul de Cercetări Metalurgice, Studii şi Cercetări de Metalurgie*, v. 5, no. 3, 1960, p. 371-390 + 1 plate.

International Mineral Processing Congress, 1960. Proceedings of a Congress arranged by The Institution of Mining and Metallurgy, held on April 6-9, 1960, at Church House, Westminster, London. Comminution, classification and thickening, flotation research, flotation practice, gravity and dense media separation, magnetic and electrical separation, chemical processing, process study, and control and testing are discussed. 1118 pp. 1960. The Institution of Mining and Metallurgy, London W.1. (TN500 In8p)

*** Direct Reduction of Iron Ore and Its Future in Steelmaking.** Subjects discussed are the basic chemistry of iron oxide reduction, the processes available, and the place of direct-reduced Fe in the future expansion of steelmaking capacity. ***J. Mackenzie.*** *British Steelmaker*, v. 27, Jan. 1961, p. 18-24.

*** Magnetite-Hematite Ore Concentrated With Separators and Spirals at New Swedish Mill.** The concentration process is described. ***Sven E. Sjöberg.*** *Mining World*, v. 23, no. 1, Jan. 1961, p. 29-31.

Recovering Manganese From Mill Rejects. In recovery of Mn from low-grade materials, laboratory studies were made of four samples of mill rejects: three from Montana and one from Peru to demonstrate that certain mill-waste products can be a potential source of Mn. ***W. A. Stickney and C. W. Sanders.*** *U. S. Bureau of Mines Report of Investigations* 5692, 1960, 11 pp. (TN21 Un3r Room 290.)

Selectivities of Laboratory Flotation and Float-Sink Separations of Coal. Compares the selectivities of diverse flotation reagents and also of flotation and float-sink methods of separation. Flotation tests, using NaCl, an alcohol-type frothing agent, and a kerosine-pine oil mixture as reagents, were made on seven coking-coal samples representing four different beds. Float-sink tests on these same coals generally gave results indicating better selectivities than those obtained in flotation tests at comparable levels of recovery. ***J. B. Gayle and A. G. Smelley.*** *U. S. Bureau of Mines Report of Investigations* 5691, 1960, 19 pp. (TN21 Un3r Room 290.)

PHYSICS

Semiconductor Surface Properties Deduced From Free Carrier Absorption and Reflection of Infrared Radiation. Reviews use of infrared radiation to study semiconductor bulk properties through absorption by the free carriers. Numerous applications of this technique and its variations are discussed whereby properties of semiconductor surfaces may be determined. Shows that the techniques described have distinct advantages over other techniques presently in use. ***N. J. Harrick.*** *Physics and Chemistry of Solids*, v. 14, July 1960, p. 60-71.

Surface States Associated With Adsorbed Atoms. When a foreign atom is in interaction with a crystal surface, discrete electron levels may exist. These levels lie outside the normal crystal bands (including any surface bands) and the corresponding wave functions are large on the foreign atom and on the crystal atoms near it in the surface, but fall to zero at points in the crystal remote from the foreign atom. Such levels allow for the formation of localized bonds between the foreign atom and the crystal. For semiconducting crystals, they can provide surface traps for either electrons or positive holes. ***T. B. Grimley.*** *Physics and Chemistry of Solids*, v. 14, July 1960, p. 227-232.

Surface Measurements on Freshly Cleaved Silicon *p-n* Junctions. Silicon (111) faces 1.5 mm x 6 mm in area and free of visible imperfections, containing a *p-n* junction, have been produced by cleavage in high vacuum. Contact potential difference (Kelvin method) across the junction indicates bending of the bands at the surface due to surface states. ***G. W. Gobeli and F. G. Allen.*** *Physics and Chemistry of Solids*, v. 14, July 1960, p. 23-26 + 2 plates.

Group Theory in Quantum Mechanics. An Introduction to Its Present Usage. Symmetry transformations, the quantum theory of a free atom, the representations of finite groups, further aspects of the theory of free atoms and ions, the structure and vibrations of molecules, solid-state physics, nuclear physics

and relativistic quantum mechanics are discussed. ***Volker Heine.*** v. IX. 468 pp. 1960. Pergamon Press, New York. (QC174.5 H36g)

* **An Extension of the Newtonian Law of Gravitation.** An attempt is made to relate such diverse phenomena as kinetic energy, rest mass energy, the size of the universe, the velocity of propagation both of light and gravitation, and the recession of the galaxies. The correlation is made by considering an extension of the Newtonian gravitational law which covers a particular simple case when the two attracting bodies are in relative motion. ***J. A. Bastin.*** *Cambridge Philosophical Society, Proceedings,* v. 56, pt. 4, Oct. 1960, p. 401-409.

* **Electromagnetism as a Second-Order Effect. II. The Electric and Magnetic Fields of a Charge Moving With Uniform Velocity.** The fields are derived from Coulomb's law, taking the transformations of the special theory of relativity as axiomatic. ***W. G. V. Rosser.*** *Contemporary Physics,* v. 1, no. 6, Aug. 1960, p. 453-466.

Plasma Oscillations in a Magnetic Field. In the presence of a uniform external magnetic field, the initial value problem for a longitudinal electron oscillation in a fully ionized plasma is treated in the range of the linear theory under the assumption that collisions are negligible and that the angle Θ between wave vector and magnetic field is not equal to $\pi/2$, and $(\mathrm{Re}(s) \neq 0$ on the complex s-plane. ***Ikuo Kaji and Masafumi Kito.*** *Physical Society of Japan, Journal,* v. 15, Oct. 1960, p. 1851-1861.

* **Investigations as Contributions to the New Tamm-Dancoff Method.** The infinite equation system between the amplitudes of the new method are interrupted by reducing to zero appropriate linear combinations (ϕ-functions) of these amplitudes. Generalizing the Ψ-functions permits the calculation of differences of neighboring eigen values, which results in better approximations and simpler equations. The method is studied with the help of quantum mechanics events. (*In German.*) Untersuchungen zur neuen Tamm-Dancoff-Methode. ***Hans Jürgen Kaiser.*** *Annalen der Physik,* v. 6, nos. 3-4, Sept. 1960, p. 131-149.

* **Electro-Optical Systems Using Fibre Optics.** A number of applications of fiber optics in electro-optical systems are evident. The new technique of drawing glass-coated glass fibers has eliminated light losses due to surface absorption. Therefore, the transmission of fibers is limited only by the coefficient of absorption of glass and for smaller diameters by the diffraction effects. ***N. S. Kapany.*** *Optica Acta,* v. 7, no. 3, July 1960, p. 201-217.

* **Semiconductor Electronics. I. Solid-State Physics.** Considers the atomic and crystalline structure of materials of all kinds, and then applies these principles to semiconductors in particular. The atomic theory, crystal structure, insulators, conductors, semiconductors, intrinsic semiconductors, extrinsic semiconductors, and statistics of semiconductors are discussed. ***Albert A. Sorensen.*** *Electro-Technology,* v. 66, no. 4, Oct. 1960, p. 95-99.

* **Analytical Methods for Permanent-Magnet Design. II.** In many magnet structures, the poles are close together and definite airgap permeances must be considered. Design methods for such magnets are given here, including the rapid and versatile technique of representing a magnet as an electrical network analog. ***Rollin J. Parker.*** *Electro-Technology,* v. 66, no. 4, Oct. 1960, p. 154 + 10 pages.

* **On the Quantization of Physical Space-Time Operators.** In order to find a clue to extending the conventional field theory in a consistent way, a physical interpretation of Dirac-Bergmann's field theory is proposed from the point of view of the uncertainty principle. The physical space-time operators introduced by them are connected with the measurement of the position. ***Ichie Watanabe.*** *Progress of Theoretical Physics,* v. 24, no. 3, Sept. 1960, p. 465-483.

Anisotropic Fermion Gas. An energy term discovered by Kohn and Luttinger is shown to have a simple geometrical meaning. ***G. Wentzel.*** *Physical Review,* v. 120, 2nd ser., no. 3, Nov. 1, 1960, p. 659.

The Theory of Brillouin Zones and Electronic States in Crystals. The one-dimensional periodic potentials, Brillouin zones, the classification of electronic states, point groups and their representations, electronic states where the space groups contain glides and screw displacements, extended K-space, large zones, quantitative estimates of wave functions and energies, and spin-orbit coupling effects are discussed. ***H. Jones.*** 268 pp. 1960. Interscience Publishers Inc., New York. (QD911 J71t)

* **The Mathematical Theory of the Electromagnetic Fields in Anisotropic Inhomogeneous Media.** ***Yoshio Hayashi.*** *Japan Academy, Proceedings,* v. 36, no. 8, Oct. 1960, p. 486-491.

* **Electrical Conductivity and Hall Effect of Ge-Si Alloys.** The preparation of Ge-Si single-crystalline or coarsely polycrystalline alloys is extensively described. The composition of the samples is determined by measurements of densities and lattice constants. Hall-constants and electrical conductivities as functions of temperature between 20 and 900 C were measured. Mobilities for electrons and holes and intrinsic carrier concentrations are calculated as functions of the alloy composition. (*In German.*) Elektrische Leitfähigkeit und Halleffekt von Ge-Si-Legierungen. ***G. Busch and O. Vogt.*** *Helvetica Physica Acta,* v. 33, no. 5, 1960, p. 437-458.

Nuclear Quadrupole Coupling With Conduction Electrons in Cubic Alloys. The coupling of the quadrupole moment of the solvent nuclei to the screening charge round an impurity is investigated by the partial wave treatment of conduction electron scattering. The magnitude of the interaction with the Cu nuclei in the system CuZn is found to be an appreciable fraction of the experimental value obtained from nuclear resonance measurements. ***C. P. Flynn and E. F. W. Seymour.*** *Physical Society, Proceedings,* v. 76, pt. 4, Oct. 1960, p. 526-531.

The Numerical Solution of the Exchange Equations for Slow Electron Collisions With Hydrogen Atoms. Numerical methods are used to calculate phases in the exchange approximation for the s-, p-, and d-wave scattering of electrons by H atoms, using small energy intervals. A discussion of experimental results. ***T. L. John.*** *Physical Society, Proceedings,* v. 76, pt. 4, Oct. 1960, p. 532-538.

Nuclear Spin Relaxation and Molecular Diffusion in Liquid Hydrogen. The nuclear spin lattice relaxation time T_1 and the diffusion coefficient D of liquid H were measured between 14 and 20 K by the spin echo technique. The temperature dependence of the quantities does not agree with recent predictions of their behavior. However, the observed dependence of T_1 on *ortho* H concentration indicates that the reorientation of the *ortho* molecules within the liquid is best explained in terms of collision theory description. ***W. P. A. Hass, G. Seidel, and N. J. Poulis.*** *Physica,* v. 26, Oct. 1960, p. 834-852.

On the Superconducting Ground State. The energy difference ΔE between the superconducting and normal states is recalculated as a function of half an energy gap μ_0, manipulating the unrenormalized Hamiltonian of Fröhlich by the method of Bogoliubov. The result is in disagreement with experiment, in contrast to Bogoliubov' work. Extension to higher orders of perturbation calculation does not remove the discrepancy. ***Ziro Mikura.*** *Physical Society of Japan, Journal,* v. 15, Oct. 1960, p. 1783-1806.

X-Ray Observations on Cleavage Faces of LiF Single Crystals. Cleavage faces of LiF single crystals were studied by the Berg-Barrett method. Boundary lines of subgrains with small tilt angle show intensity enhancement. The intensity enhancement is also seen for boundaries lying closely to the surface. As to deformations produced by cleaving, more information such as slip direction is obtained than by etch-pit photographs. ***Mitsuru Yoshimatsu and Kazutake Kohra.*** *Physical Society of Japan, Journal,* v. 15, Oct. 1960, p. 1760-1770.

Strain-Broadening of Nuclear Magnetic Resonance Lines in Copper. The mean-square width of the nuclear magnetic resonance absorption line in Cu sheet was measured with an accuracy of $\pm 4\%$, using specimens from a sample of Cu (99.98% Cu) on which stored energy measurements had already been made. Plastic deformation was found to increase the mean-square line width by up to 40% and there is evidence that the broadening is proportional to the stored energy. There is also a small reduction in the integrated intensity of the line in de-

formed specimens, possibly caused by the high strains in regions near the cores of dislocations. The results can be interpreted satisfactorily on a model where both the line width and the stored energy are calculated from the state of strain of the material. ***E. A. Faulkner.*** *Philosophical Magazine*, v. 5, ser. 8, Aug. 1960, p. 843-851.

Optical Properties of Alkali Halide and Thallium Halide Single Crystals. The large single crystals were produced by Bridgman-Stockbarger method. The absorption spectra of KRS-5, TlBr and TlCl with the several thickness near the short edge were measured and compared with the results of various investigators. The impurity band of Tl compound and the red shift of short edge were found as well as reflectance spectra of NaF, TiCl and KRS-5 in the far infrared region. ***Masahiro Oura.*** *Review of Physical Chemistry of Japan*, v. 30, no. 1, 1960, p. 25-33.

The Theory of Spin Waves. The method of spin waves is one of the main links that make up the theory of ferromagnetism. This method enables us to calculate the fundamental characteristics of a ferromagnetic substance: the free energy, the specific heat, the dependence of the saturation magnetization on the temperatures, and so on. Spin waves also play an important role in the phenomenon of ferromagnetic resonance, and in its many new applications. Fundamental relations are derived. ***M. A. Gintsburg.*** *Soviet Physics - Solid State (Cover-to-cover translation of Fizika Tverdogo Tela)*, v. 2, Nov. 1960, p. 833-840.

The Mössbauer Effect. Reviews the recent discovery and several important applications of recoilless γ-ray fluorescence. From among the large number of recent experiments which make use of the Mössbauer effect, two groups are selected for discussion. The first is concerned with the discovery of nuclear and magnetic properties of iron-57; the other with a test of the principle of equivalence in general relativity, by a measurement of the gravitational shift in the frequency of radiation. ***Harry Lustig.*** *American Journal of Physics*, v. 29, no. 1, Jan. 1961, p. 1-18.

Controlled Thermonuclear Reactions. An Introduction to Theory and Experiment. Physical conditions for thermonuclear reactions, possible approaches to controlled fusion, elementary plasma theory, formation and heating of plasma, plasma diagnostic techniques, the pinch effect, the stellarator, magnetic mirror systems, the astron system, miscellaneous proposals for plasma confinement and heating, energy losses and scaling laws, plasma stability theory are discussed. ***Samuel Glasstone and Ralph H. Lovberg.*** 523 pp. 1960. D. Van Nostrand Co., Inc., New York. (QC791 G46c)

Electron Optical Study of Basal Dislocations in Graphite. The dislocations are dissociated into ribbons consisting of two partials separated by a stacking fault. Specific models for these dislocations are presented. Hexagonal networks contain extended and contracted nodes. The presence of two types of stacking faults gives rise to singularities which are analyzed in terms of experimentally determined Burgers vectors. ***S. Amelinckx and P. Delavignette.*** *Journal of Applied Physics*, v. 31, Dec. 1960, p. 2126-2135.

Bounds on Low-Energy Scattering Parameters. Some recent results that determine an upper bound on the scattering length, whether or not composite bound states exist, are reviewed. The extension to the determination of an upper bound on $(-k\ cot\ \eta)^{-1}$, where only one channel is open, is presented; the method used requires that the potential vanish identically beyond some given point. The results are applicable to the scattering of one compound system by another. ***Larry Spruch and Leonard Rosenberg.*** *Journal of Applied Physics*, v. 31, Dec. 1960, p. 2104-2111.

Theory of the Compressibility of Solid He^4 and He^3 at 0°K. A quantum mechanical variational method is used to calculate several properties of a close-packed lattice phase of solid He^4 and He^3 at 0 K. The method consists in expressing the expectation value of the interatomic potential energy, with respect to a Heitler-London trial wave function, as a series of powers of the mean square deviation of an atom from its lattice site. Due to the small mass of a He atom, this mean square deviation is relatively large and the series converges slowly.

The calculations are repeated for a body-centered cubic lattice, and no indication of a crystallographic phase transition is found. ***Newton Bernardes.*** *Physical Review*, v. 120, 2nd ser., no. 6, Dec. 15, 1960, p. 1927-1932.

Far Infrared Studies of Bismuth. The zero-field and magneto-optic studies of Bi reported here cover a range of frequencies where the plasma effects are large and rapidly changing. It is found that the data lend themselves to an interpretation in terms of classical magneto-plasma theory when anisotropy is taken into account. ***W. S. Boyle and A. D. Brailsford.*** *Physical Review*, v. 120, 2nd ser., no. 6, Dec. 15, 1960, p. 1943-1949.

Ferroelectric Properties of $BaLi_{2x}Al_{2-2x}F_{4+x}O_{4-4x}$. Single crystals of $BaLi_{2x}Al_{2-2x}F_{4+x}O_{4-4x}$, where $x = 0.15$ to 0.30, have been found to be ferroelectric with a Curie temperature in the range 127-153 C and a room-temperature spontaneous polarization along the hexagonal c axis of approximately 0.1 μcoul/cm^2. The structure of these mixed crystals is unrelated to that of any previously known ferroelectric, but appears to be very similar to that of $BaAl_2O_4$. ***T. G. Dunne and N. R. Stemple.*** *Physical Review*, v. 120, 2nd ser., no 6, Dec. 15, 1960, p. 1949-1950.

General Spin-Wave Dispersion Relations. In contrast to previous calculations, the effects of conductivity, relaxation, exchange, and propagation are all properly taken into account. The resulting algebraic equation, being biquadratic in the square of the wave number, k^2, has four possible pairs of solutions. Some of these solutions correspond to growing plane waves while others represent attenuated ones in the direction of propagation. ***R. F. Soohoo.*** *Physical Review*, v. 120, 2nd ser., no. 6, Dec. 15, 1960, p. 1978-1982.

Color Centers in Cesium Halide Single Crystals. Cesium chloride, bromide, and iodide single crystals were grown from the melt and CsCl crystals also from solution. Coloration was produced by 130-kv X-rays, 3.0-Mev electrons, and by electrolysis. In CsI coloration resulted from electrolysis only. After coloration, all three crystals show one strong band in the visible (near infrared for CsI) and several weaker bands at shorter and longer wavelengths. ***P. Avakian and A. Smakula.*** *Physical Review*, v. 120, 2nd ser., no. 6, Dec. 15, 1960, p. 2007-2014.

Microwave Modulation of Light in Paramagnetic Crystals. The considerations of Dehmelt and several other workers about the modulation of light by radio-frequency signals in atomic vapors are extended to paramagnetic solids. It is shown that these materials, driven near a microwave resonance at low temperatures may be used both to create and to detect modulation of light at microwave frequencies. ***N. Bloembergen, P. S. Pershan, and L. R. Wilcox.*** *Physical Review*, v. 120, 2nd ser., no. 6, Dec. 15, 1960, p. 2014-2023.

Field-Effect Modulation of Photoconductance in a Quasi-Intrinsic Semiconductor. The field-effect modulation of conductance in a dark-insulating photoconductor is strongly dependent on the properties of carriers of both signs. An analysis of the equilibrium space charge density resulting from electron-hole pair generation in a "depletion layer" and the resulting influence on the terminal characteristics of a photoconductive field-effect transistor is presented. ***R. R. Bockemuehl.*** *Journal of Applied Physics*, v. 31, Dec. 1960, p. 2255-2259.

Changes in Macroscopic Shape, Lattice Parameters, and Density in Crystals Due to Point Defects. ***R. W. Balluffi and R. O. Simmons.*** *Journal of Applied Physics*,, v. 31, Dec. 1960, p. 2284-2288.

Measurement of Thermal Conductivity by Utilization of the Peltier Effect. II. Correction for Wire Radiation and Determination of Specimen Radiation Emissivity. The analysis in the first article on measurement of thermal conductivity by utilization of the Peltier effect is extended to correct for radiation of heat from the lead wires. It is shown how the radiation emissivity of the semiconductor specimen can also be determined from the measured temperatures. ***R. Simon, R. T. Bate, and E. H. Lougher.*** *Journal of Applied Physics*, v. 31, Dec. 1960, p. 2160-2164.

Testing Quantum Electrodynamics by Means of Compton Scattering and Pair Annihilation. After a short discussion of the introduction of the form factors we consider the possibility

of a (partial) cancellation between electrodynamic and nucleon structure effects. There is also the possibility of a partial cancellation of the nonlocal effects in Compton scattering and wide angle bremsstrahlung because of the opposite action of space-like and time-like form factor arguments. (*In German.*) Prüfung der Quantenelektrodynamik durch Compton-Streuung und Paarvernichtung. ***H. Salecker.*** *Zeitschrift für Physik*, v. 160, no. 4, 1960, p. 385-405.

* **Magnetohydrodynamic Shock Waves in a Gas Mixture.** The properties of the nonrelativistic propagation of a plane shock wave in a gas mixture of charged particles in the presence of an external uniform magnetic field, oriented in a direction transverse to the direction of propagation, are studied. Expressions for the pressure, density and velocity ratios are obtained. It is shown that the presence of a transverse magnetic field narrows down the range of values of the density ratio. ***K. P. Chopra and I. J. Singh.*** *Zeitschrift für Physik*, v. 160, no. 4, 1960, p. 431-437.

Device for Generating a Low Temperature, Highly Ionized Cesium Plasma. A device for generating a linear, highly ionized, low temperature cesium plasma is described. The plasma is generated by having the output of cesium atomic beam ovens impinge on hot W plates placed at both ends of a cylindrical vacuum chamber. The walls of the chamber are cooled so that neutral Cs condenses on them. The theory of the device, designated as the Q machine, is presented and some experimental results given. The maximum density achieved was $2 \times 10^{13}/cm^3$, with an estimated fractional ionization of 99%, and a confining field of 5900 gauss. ***Nathan Rynn and Nicola D'Angelo.*** *Review of Scientific Instruments*, v. 31, Dec. 1960, p. 1326-1333.

* **A Contribution to the Theory of the Plasmas in the Presence of Magnetic Fields.** The effect of electron-electron interaction is thoroughly included by expansions in terms of Sonine polynomials. The formulae of the current density and heat flow components of n-th order approximation explicitly determined here are derived in terms of mean free paths which depend on the directions of transport as well as of the producing gradient. (*In German.*) Zur Theorie der Plasmen bei Anwesenheit magnetischer Felder. ***J. Friedrich.*** *Zeitschrift für Physik*, v. 160, no. 5, 1960, p. 494-503.

* **A Contribution to the Magnetic Resistance Change Theory. II.** The oscillating change of the electric resistance is calculated on the basis of a simple quantum theory of free electrons in the magnetic field, which takes into account the discrete structure of the energy. More accurate investigations of the impact time and of the density matrix confirm the results. They also agree with those obtained by solving a transport equation. (*In German.*) Zur Theorie der magnetischen Widerstandsänderung. II. ***János Hajdu.*** *Zeitschrift für Physik*, v. 160, no. 5, 1960, p. 481-490.

* **Statie Electromagnetic Fields in General Relativity.** Presents the solutions of the equations of Rainich's "already unified theory" for the case when the field is static and the diagonalized metric tensor components are functions of one coordinate alone. Although the solutions obtained occur already in the literature, the new approach seems interesting and it is proposed to extend the investigation to more complicated cases. ***Amal Kumar Raychaudhuri.*** *Annals of Physics*, v. 11, Dec. 1960, p. 501-509.

* **Theoretical and Experimental Study of Two Aspects of Diffraction by Means of the Optical Gratings: The Development of the Defects in the Diffraction Patterns and the Electromagnetic Origin of the Distribution Between the Orders.** A general equation is given, relating the diffracted wave-front aberrations (as caused by grating errors and grating-blank defects) to the distribution of light in the corresponding diffraction patterns. A study of the diffracted light among the waves of various orders is based on the electromagnetic interpretation of the diffraction phenomenon. The extension of the method of exact solution to gratings of arbitrary groove shape (in particular almost rectangular shapes) appears possible. (*In French.*) Étude théorique et expérimentale de deux aspects de la diffraction par les réseaux optiques: l'évolution des défauts dans les figures de diffraction et l'origine électromagnétique de la répartition entre les ordres. ***George W. Stroke.*** *Revue d'Optique Théorique et Instrumentale*, v. 39, nos. 7-8, July-Aug. 1960, p. 291-396 + 12 plates.

* **Electroconductivity of Liquid Selenium in Strong Electric Fields.** Fields up to 10^5 v/cm between 180 and 350 C were applied. The bridge method under pulse conditions was used. The effects of impurities of up to 1% I revealed that a 0.3% I impurity corresponds to the maximum effect of the strong field. The dependence of the electroconductivity on the voltage of the electric field agrees approximately with the Frenkel formula concerning fields above 10^4 v/cm, and deems to be an extrapolation of the data concerning the analogical effect in amorphous Se. (*In Russian.*) Elektroprovodnost' zhidkogo selena v sil'nykh elektricheskikh poliakh. ***A. A. Andreev and A. R. Regel'.*** *Fizika Tverdogo Tela*, v. 2, no. 11, Nov. 1960, p. 2770-2775.

* **Oscillation of the Absorption Coefficient in Tellurium in a Magnetic Field Directed Along the Optic Axis of a Crystal.** The authors examined the region of frequency ($\sim$ 0.1ev) in which the absorption is considered by the direct passages of the electrons into the p-type region from the filled valence zone distributed below the p-type zone. The calculation was made according to the single electron approximation method of the effective mass. From the shape of the spectrum, conclusions were drawn concerning the parameters characterizing the zones indicated. (*In Russian.*) Ostsilliatsii koeffitsienta pogloshcheniia v tellure v magnitnom pole, napravlennom vdol' opticheskoi osi kristalla. ***L. I. Korovin and T. Iu. Bulashavich.*** *Fizika Tverdogo Tela*, v. 2, no. 11, Nov. 1960, p. 2795-2804.

* **Zero Point Energy and Arrangement of Non-Commuting Factors in a Hamiltonian Operator.** In the case of the harmonic oscillator the zero point energy can be removed by a perfectly legitimate reordering of the factors p and q (i.e. by writing H as a "normal product"). This raises the question whether physical effects that confirm the existence of a zero point energy mean that only one particular choice of the order of the p's and q's in H is correct. For the case of the sublimation pressure of isotopes and of the Casimir effect, this is discussed in full detail. (*In German.*) Nullpunktsenergie und Anordnung nicht vertauschbarer Faktoren im Hamiltonoperator. ***C. P. Enz and A. Thellung.*** *Helvetica Physica Acta*, v. 33, no. 8, 1960, p. 839-848.

* **Long Range Interactions Between Magnetic Moments in Semiconductors.** The interaction between magnetic moments embedded in a nondegenerate electron gas is calculated. In the fully degenerate gas the Rudermann, Kittel interaction applies, whereas in the Boltzmann gas the interaction is ferromagnetic only and of comparatively long range. Between these extreme cases the behavior changes gradually. In a semiconductor, an additional interaction comes from the virtual excitations of the valence band. These two interactions and the magnetic dipole interaction may be of comparable magnitude in dilute magnetic semiconducting alloys. ***W. Baltensperger and A. M. deGraaf.*** *Helvetica Physica Acta*, v. 33, no. 8, 1960, p. 881-888.

* **Magnetic Susceptibility of Ge-Si-Mixed Crystals.** Magnetic susceptibilities as a function of temperature were measured between 300 and 1200 K for a set of 34 Ge-Si mixed crystal samples. Assuming an ellipsoidal structure of the conduction band edge and two concentric spheres for the valence band edge it is possible to compare our results with measurements of cyclotron resonance and magnetoresistance. We are able to calculate effective masses for holes and electrons over the whole concentration range. (*In German.*) Magnetische Suszeptibilität von Ge-Si-Mischkristallen. ***G. Busch and O. Vogt.*** *Helvetica Physica Acta*, v. 33, no. 8, 1960, p. 889-910.

* **On the Optical and Electrical Properties of Semitransparent Copper Films.** Simultaneous measurements were made of the optical constants n and k, reflectance R, transmittance T, and of the d-c conductivity σ, of semitransparent copper films deposited onto quartz by evaporation *in vacuo*. All depositions were carried out at a pressure $p \approx 10^{-5}$ mm Hg and with a deposition rate $D \approx 2$ Å/sec. The optical constants were determined by an ellipsometer with a photomultiplier tube attachment at the wavelengths 435 mμ, 546 mμ, and 630 mμ. The reflectance values were computed from the optical constants. The transmittance values were measured at these wavelengths by a unicam spectrophotometer.. The d-c conductivities were measured by a kohlrausch bridge. These measurements were carried out in the thickness range 60 Å to 455 Å. The dis-

agreement of the results with the Garnett theory and the Fuchs theory is discussed and conclusions regarding the structure and the degree of porosity are drawn. ***R. S. Adhav.*** *Canadian Journal of Physics*, v. 38, Dec. 1960, p. 1570-1576.

PLASTICS

Recent Developments in Polyolefins. While the Ziegler-type catalysts have been of major interest, the field of study of new catalyst systems is rapidly expanding. Lithium alkyls have been extensively studied for the polymerization of di-olefins and some polar monomers. Important discoveries have been made in the field of polymerization of the olefin oxides. ***C. E. H. Bawn.*** *Institute of Petroleum, Journal*, v. 46, Nov. 1960, p. 374-381.

The Ageing of Plastics. II. The anticipation and prevention of aging, preparation of materials, conditions for accelerated aging, choice of acceleration factors, methods of accelerated aging, and evaluation of aging are discussed. ***P. Dubois and J. Hennicker.*** *Plastics (London)*, v. 25, Nov. 1960, p. 474-478.

Heat Treatment of Irradiated Polypropylene. Many trapped radicals produced during irradiation, which are stable at room temperature, could contribute to delayed cross-linking on annealing the irradiated polymer after irradiation. ***Hiroshi Sobue and Yoshio Tazima.*** *Nature*, v. 188, Oct. 22, 1960, p. 315-316.

* **One-Shot Process for Urethane Foams.** The discovery of the high catalytic activity (isocyanate-active hydrogen) of certain organotin compounds has been the most recent development accelerating tonnage growth of urethane foam production. This discovery led to the "one-shot" foaming process for polyethers which previously had to be polymerized in a two-step process because of extremely slow reactivity with amine catalysts. ***G. P. Mack.*** *Fibres and Plastics*, v. 21, Nov. 1960, p. 342 + 2 pages.

* **Organic Peroxides as Polymerization Initiators. II.** Organic peroxides for production of polyester resins, polyolefins, polyvinyls, polyacrylic products, and polystyrene are discussed. ***J. W. Cywinski.*** *Applied Plastics*, v. 3, Nov. 1960, p. 56-62.

* **Structure of Bridgman's Black Carbon Disulphide.** Infrared spectrum of black carbon disulphide dispersed in a potassium bromide disk was studied. Blackness and the infrared spectrum are consistent with its being a linear polymer, $-(C{=}S.S)_n-$. ***E. Whalley.*** *Canadian Journal of Chemistry*, v. 38, Nov. 1960, p. 2105-2108.

Conference on Fiber Glass Reinforced Plastics. II. Conclusion. Papers on reinforced plastics used in missiles, firearm barrels, pipe, chemical industry, and truck cabs are presented. *Glass Industry*, v. 41, Nov. 1960, p. 638-640.

* **Mechanical Properties of Polystyrene and Their Molecular-Physical Significance.** With the help of free-torsion oscillations, the modulus of shear of cross-linked and swollen polystyrene was measured as a function of temperature. The temperature was varied between 120 and 200 C. Notions concerning the intermolecular structure of glassy polystyrene were derived from the results of different physical investigations, permitting a qualitative molecular interpretation of the mechanical-thermal measurements and effects of chemical variation and plasticizing on the process. (*In German.*) Mechanische Eigenschaften von Polystyrol und ihre molekular-physikalische Deutung. ***G. Adam.*** *Kolloid-Zeitschrift*, v. 172, no. 2, Oct. 1960, p. 132-141.

Optical and Other Electronic Properties of Polymers. The properties of a polymer are related to the properties of its constituent groups and to its geometry. The main assumption in the derivation is that no exchange occurs between groups of electrons. The usefulness of these wave functions is illustrated by expressions for the absorption coefficient, polarizability, optical rotation, dipole moment, and stability of a polymer. ***Ignacio Tinoco, Jr.*** *Journal of Chemical Physics*, v. 33, Nov. 1960, p. 1332-1338.

Polymerization of Styrene by *n*-Butyllithium. II. Effect of Lewis Acids and Bases. The rate of polymerization of styrene initiated by *n*-butyllithium is greatly accelerated by small quantities of Lewis bases, such as ethers or amines, and retarded by Lewis acids, such as zinc or aluminum alkyls. Evidence is presented which confirms that acids form complexes of the type RLi·A with lithium alkyls, whereas bases form complexes of the type RLi·2B. The strength of the complexes with bases decreases in the order tetrahydrofuran >2,5-dimethyltetrahydrofuran >ethyl ether, triethylamine. With acids the order is triisobutylaluminum >di-*n*-butylzinc. ***F. J. Welch.*** *American Chemical Society, Journal*, v. 82, Dec. 5, 1960, p. 6000-6005.

* **Chlorination of Ethylene-Propylene Copolymers.** The chlorination of ethylene-propylene copolymer is the first step of a new process studied for the introduction of double bonds in the saturated copolymer chains; by these means, it is possible to vulcanize the copolymer with the conventional sulfur compounds. Chlorination curves of copolymers with combined chlorine up to 40% are reported. (*In Italian.*) La clorurazione dei copolimeri etilene-propilene. ***Mario Bruzzone and Giovanni Crespi.*** *Chimica e l'Industria*, v. 42, Nov. 1960, p. 1226-1230.

* **Investigation of Interfacial Polyesterification.** A number of factors affecting the interfacial polyesterification of dian and terephthalyl chloride were investigated. The molecular weight and yield of the polyester were studied as functions of the concentrations of the solutions of reagents, of the temperature, of the stirring time and of the amount of alkaline agent. (*In Russian.*) Issledovanie reaktsii polieterifikatsii na granitse razdela faz. ***I. P. Losev, O. V. Smirnova, O. G. Fortunatov, and A. D. Neklyudov.*** *Vysokomolekuliarnye Soedinenila*, v. 2, no. 11, Nov. 1960, p. 1659-1664.

* **Dilatometric Determination of Polymer-Compatibility.** The curves for the linear temperature shrinkage of elastomers permit a clear cut determination of the compatibility or non-compatibility of polymers, provided their glass transition temperatures are not near each other. Mixtures of non-compatible polymers manifest a number of glass transition temperatures (acccording to the number of polymers). The values of these temperatures coincide with those for the pure polymers, being independent of the ratio of polymers in the mixture. ***G. M. Bartenev and G. S. Kongarov.*** *Vysokomolekuliarnye Soedinenila*, v. 2, no. 11, Nov. 1960, p. 1692-1697.

Inorganic Polymers. Current interest in inorganic polymers is concerned largely with resistance to high temperatures, to radiation and to oxidation. One of the difficulties in the search for high thermal stability is that structures having this property possess frequently polar bonds, and this often leads to breakdown by water. ***R. A. Shaw.*** *New Scientist*, v. 8, Dec. 15, 1960, p. 1603-1605.

Molecular Size Distribution and Gelation of Irradiated Copolymers. The radiation-induced change in the molecular size distribution is described by an integro-differential equation, which is solved by means of Laplace transform for an arbitrary initial distribution to obtain the number-average as well as the weight-average degree of polymerization as a function of radiation dose. Further, the gel point, or the dose required for incipient gelation, is given as a function of concentrations of the monomer units constituting the copolymeric system. ***Mitio Inokuti.*** *Journal of Chemical Physics*, v. 33, Dec. 1960, p. 1607-1615.

Effect of Corona Discharges on Polyethylene. *n*-Eicosane was used as a model compound for polyethylene. The paraffin was subjected to corona discharges in air, oxygen and carbon dioxide. After exposure to corona discharges for 25-50 hr., the paraffin, which was now partly oxidized, was treated with lithium aluminium hydride in tetrahydrofuran, after which the resulting alcohols were separated by gas chromatography. Only the *n*-mono-alcohols are present. ***L. R. Hougen.*** *Nature*, v. 188, Nov. 12, 1960, p. 577-578.

Epoxy Resins: Market Survey and Users' Reference. ***Gordon F. Kingsley, et al.*** 175 pp. + appendices. 1959. Harvard University, Cambridge, Mass. (TP986.E6 B67e Over.)

* **Polymerization of Propylene Over a Mixed Oxide-Nickel-Molybdenum Catalyst on an Oxide-Aluminum Carrier.** The investigation was conducted at atmospheric pressure, between 140 and 200 C and with volume rates of the gas delivery of 15-50 hours^{-1}. The maximum depth of propylene transformation

and the highest yields of fractions of the polymerizate are observed at 160 C and with low volume rates of gas delivery (15-20 hours^{-1}). The polymerizate basically consists of propylene dimers. Increasing the rates and temperature beyond these values lower the results. (*In Russian.*) Polimerizatsiia propilena nad smeshannym okisno-nikel'-molibdenovym katalizatorom na okisno-aliuminievom nositele. ***G. M. Panchenkov and Ch. S. Karryev.*** *Izvestiia Vysshikh Uchebnykh Zavedenīi, Neft' i Gaz,* v. 3, no. 11, 1960, p. 71-74.

a

* **Present State of Pe-Ce Manufacture.** Fundamental considerations on chlorination dealing with the entrance of chlorine into the monomeric unit, the solubility of PVC and PC as well as cross linking and depolymerization reactions, are followed by a description of the technical organization of Pe-Ce manufacture. It includes chlorination in the homogeneous system, tetrachlorethane, chloroform and other solvents. The isolation of the chlorinated PVC can follow from a distillatory regeneration adding water, passing through a nozzle in the hot-air current, or a precipitation using nondissolving liquids. (*In German.*) Über den heutigen Stand der PeCe-Herstellung. ***R. Kuschk and H. Kaltwasser.*** *Plaste und Kautschuk,* v. 7, Nov. 1960, p. 528-533.

b

* **Polymerization With Redox Initiators. III. Complex Formation Between Benzoyl Peroxide and Dimethylaniline.** When a dilute solution of benzoyl peroxide is mixed with one of dimethylaniline, the resultant solution has an absorbence in the ultraviolet which is different from that which can be calculated assuming no interaction. The difference is temperature dependent and reversible. It is believed that the absorbence difference may be attributed to the rapid equilibrium formation of a complex between the amine and peroxide. ***K. F. O'Driscoll E. N. Richezza.*** *Journal of Polymer Science,* v. 46, Sept. 1960, p. 211-216.

c

* **Degradation and Crosslinking in Irradiated Polyamides and the Effect of Oxygen Diffusion.** The changes in relative viscosity which occur when nylon 66 is irradiated with 2 m.e.v. electrons under an oxygen-free atmosphere under various conditions were observed. A mechanism is proposed which reconciles all of these observations, and on the basis of this postulated mechanism, yields of chain breaks and crosslinks are calculated. The effect of the presence of a small concentration of a vinyl monomer (acrylic acid) in the polymer during irradiation on degradation and crosslinking is also considered. The rate of penetration of O_2 into irradiated polyamides has been measured. There is a marked reduction in penetration rate which results from the presence of free radicals in the fiber and the irreversible reaction which results. The effect of filament diameter on the extent of degradation which occurs when fibers of nuylon 66 are irradiated and then exposed to air was investigated. The marked dependence of degradation on fiber thickness is related qualitatively to the data on rate of O_2 penetration. ***Joseph Zimmerman.*** *Journal of Polymer Science,* v. 46, Sept. 1960, p. 151-162.

d

* **Studies on Polyoxypropylene Glycols. II. Derived Thermodynamic Functions for the Systems: Polyglycols-Methanol. III. Equilibrium Swelling of Crosslinked Polyurethane Elastomers. IV. Elastic Properties of Derived Elastomers.** II. ***B. E. Conway and M. L. Lakhanpal.*** III. ***B. E. Conway and S. C. Tong.*** IV. ***B. E. Conway.*** *Journal of Polymer Science,* v. 46, Sept. 1960, p. 93-138.

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* **Degradation of Poly(ethylene Oxide).** The degradation of high polymers of ethylene oxide in aqueous and organic solutions is accelerated by strong acids, certain oxidizing agents, ultraviolet light, and certain heavy metal ions. The effectiveness of the latter two components is related to the solution stability of various polymer samples upon long-term, natural aging. These facts are interpreted by assuming that poly(ethylene oxide) degrades primarily by autoxidation, giving hydroperoxides which decompose by polymer chain cleavage. Aqueous polymer solutions containing alcohols, such as isopropyl alcohol, are very stable to all of the normally detrimental aging conditions. The effectiveness of the alcohol is related to the theoretical ease with which the α-hydrogen atom is extracted, and, consequently, these effects are interpreted in view of the selective autoxidation of the alcohol present. Other types of stabilizers were investigated. ***C. W. McGary, Jr.*** *Journal of Polymer Science,* v. 46, Sept. 1960, p. 51-57.

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* **The Study of the Polydispersity of Polymers by Viscometry.** A viscometric polydispersity index may be calculated by forming the ratio of the viscosity-average molecular weights of a polymer in a relatively good solvent and in a relatively poor solvent and subtracting 1. This index has been examined by measuring dilute solution viscosities of a polydisperse polystyrene and a polydisperse methyl methacrylate in a variety of solvents, calculating viscosity-average molecular weights using Mark-Staudinger-Houwink equations, and forming the viscometric polydispersity indices. Viscometric polydispersity indices are more sensitive to polydispersities than expected when compared to Schulz parameters if account is taken of the differences in the powers of molecular weight in the various molecular weight sums. The weight-average-viscosity-average polydispersity index is more sensitive than the viscometric polydispersity index and may be used to characterize relatively monodisperse linear polymers. ***J. L. Lundberg, M. Y. Hellman, and H. L. Frisch.*** *Journal of Polymer Science,* v. 46, Sept. 1960, p. 3-17.

* **The Determination of the Relative Isotactic Content of Polypropylene by Extraction.** Under controlled conditions, the extraction of polypropylene with first diethyl ether and then *n*-heptane will give reproducible results. It is necessary to extract with heptane in an atmosphere of N_2. The values obtained by the extraction procedure described are regarded as relative measures of the amounts isotactic, stereoblock and atactic material present in a sample. ***Charles A. Russell.*** *Journal of Applied Polymer Science,* v. 4, no. 11, Sept.-Oct. 1960, p. 219-224.

* **Methyl α-Cyanoacrylate. I. Free-Radical Homopolymerization.** Methyl α-cyanoacrylate, when suitably inhibited by Lewis acids against anionic polymerization, can be polymerized readily with free-radical initiators to form hard, clear, high molecular weight polymers. The homopolymer is thermally unstable at temperatures only slightly above the glass temperature (estimated to be 165-170 C). Degradation of the polymer under gamma irradiation is pronounced, only 18 e.v. being required per main-chain scission. ***A. J. Canale, et al.*** *Journal of Applied Polymer Science,* v. 4, no. 11, Sept.-Oct. 1960, p. 231-236.

* **Properties of High Modulus Reinforced Plastics.** Glass filament containing beryllium oxide increases modulus to approximately 17 million psi. ***George P. Peterson.*** *SPE Journal,* v. 17, Jan. 1961, p. 57-62.

* **Relations Between Physical Properties and Molecular Structure of Polypropylenes. *N. H. Shearer, Jr., J. E. Guillet, and H. W. Coover, Jr.*** *SPE Journal,* v. 17, Jan. 1961, p. 83-88.

* **Molding With Plastisols.** Describes slush and rotational molding of Poly(vinyl chloride) articles. Included is a description of the process, and formulations and manufacturing procedures. ***Howard G. Nadell.*** *SPE Journal,* v. 17, Jan. 1961, p. 89-90.

* **Preparation of Polytrimethylsilylstyrene.** Substitution by the trimethylsilyl group in the para position on the polystyrene component was obtained by two different methods: by the action of monochlorotrimethylsilane on polyparabromostyrene in the presence of Li; by the action of monochlorotrimethylsilane on polyparastyryllithium. A completely substituted polymer was produced by the second method. (*In French.*) Sur la préparation de polytriméthylsilylstyrène. ***Bertrand Houel and Mihailo S. Jaćović.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences,* v. 251, no. 22, Nov. 28, 1960, p. 2523-2525.

Estimating Thermal Stability of Experimental Polymers by Empirical Thermogravimetric Analysis. *C. D. Doyle.* *Analytical Chemistry,* v. 33, Jan. 1961, p. 77-79.

* **Strength Characteristics of Polymers at High Deformation Rates.** A method for mechanical testing of polymers at high deformation rates, up to 2.7 x 10^6 *mm/min* and wide range of temperatures has been developed. The strength characteristics have been shown to change irregularly with temperature. The anomalies in the correlation of the ordinary strength characteristics obtained under the above conditions may lead to non-unilateral results when these characteristics are employed for comparing polymers. (*In Russian.*) Issledovanie kharakteristik prochnosti polimerov pri bol'shikh skorostiakh de-

formatsii. ***V. E. Gul, V. V. Kovriga, and E. G. Eremina.*** *Vysokomolekuliarnye Soedineniia*, v. 2, no. 11, Nov. 1960, p. 1616-1619.

*** Two Types of Plastification of Rigid Chain Polymers.** The thermomechanical curves of cellulose specimens plasticized by guanidine thiocyanates at various percentages of the plasticizers from 0 to 60% were studied, as well as the dependency of the temperatures of vitrification of cellulose on the amount of plasticizer introduced for triethylphenylammonium oxide, guadinine thiocyanate and urea. Intrabundle and interbundle plastifications were described. (*In Russian.*) O dvukh tipakh plastifikatsii zhestkotsepnykh polimerov. ***V. A. Kargin, P. V. Kozlov, R. M. Asimova, and L. I. Anan'eva.*** *Akademiia Nauk SSSR, Doklady*, v. 135, no. 2, Nov. 1960, p. 357-360.

Polyurethane Foams: Methods of Production, Properties and Applications. *J. M. Buist, R. Hurd, and A. Lowe.* *Chemistry & Industry*, 1960, no. 51, Dec. 17, p. 1544-1558.

The Physical Adsorption of Hydrogen on Polyethylene and Teflon. No significant difference between the adsorption of para and normal H_2 was found with these adsorbents. Polyethylene appears to be a slightly better adsorbent for H_2 than is Teflon. The differential isosteric heat of adsorption decreases with increasing surface coverage for both adsorbents. ***W. Thompson.*** *Physica*, v. 26, Nov. 1960, p. 890-916.

The Effect of Carbon Number on the Alkylation Behaviour of a 150°-250° C Cut From Full Range Propylene Polymer. Quantitative hydrogenation was used to determine the carbon number distribution in a 150-250 C olefin cut from the polymerization of propylene over a phosphoric acid catalyst. The behavior of distilled fractions from this boiling range when alkylated with benzene was assessed by alkylate yield, and by the consumption of aluminum chloride when laboratory alkylations were carried out under standard test conditions. ***E. L. Bertrand and N. J. H. Small.*** *Institute of Petroleum, Journal*, v. 46, Dec. 1960, p. 397-402.

POLLUTION AND WASTES

*** The Treatment of Pickling Lye and Effluents of the Iron-Processing Industry With the Aid of Ion-Exchange Diaphragms.** Ion-exchange diaphragms were developed as a method which meets the requirement of modest space, sturdy construction, simplicity of operation, and immunity to irregularities. Describes application. ***H. Quitmann.*** *Wire*, no. 49, Oct. 1960, p. 204-208.

*** Cobalt Oxides as Catalysts for the Complete Combustion of Automobile Exhaust Gases.** With the aid of cobalt oxide catalysts, it is possible to achieve a good conversion of the unburnt constituents of exhaust gases from gasoline engines for long periods of service, before the catalyst is spent. Long-duration tests carried out on unsupported and $CaAl_2O_4$-supported Co_3O_4 gave very promising results so far as conversion efficiency, ignition power, and resistance to lead poisoning are concerned. Both of these materials were prepared by decomposition of cobalt nitrate; their specific surface area is rather low. ***Herbert Schachner.*** *Cobalt*, no. 9, Dec. 1960, p. 12-21.

The Proceedings of the Diamond Jubilee International Clean Air Conference. Papers from Conference held in London, Oct. 20-23, 1959. National air pollution problems, legislation, education; observations, investigations, and measurement of air pollution; research and international cooperation are discussed. 290 pp. 1960. National Society for Clean Air, London. (TD884 In8)

*** A Contribution to the Directed Coagulation and Dispersion of Very Fine-Grained Dry Minerals.** The influence of surface-active substances on dust-air mixtures was studied. Coagulation or dispersion of dust particles can be achieved as desired depending on the type and quantity of substance added. The change in the electrical charge on the particle is considered to be the cause of this phenomenon. (*In German.*) Ein Beitrag zur gezielten Koagulation und Dispersion feinstkörniger trockener Mineralien. ***Wilhelm Süsse.*** *Staub*, v. 20, Dec. 1960, p. 429-438.

*** A Simplified Method for Determining Ozone Levels in Community Air Pollution Surveys.** The modified rubber cracking method and the equipment, laboratory bench work, calibration procedure, rubber strip calibration test runs, temperature effects, and investigation results are discussed. ***Theodore Vega and Clifton J. Seymour.*** *Air Pollution Control Association, Journal*, v. 11, no. 1, Jan. 1961, p. 28 + 6 pages.

*** The Petroleum Industries' Air Pollution Control Program. *G. A. Lloyd.*** *Air Pollution Control Association, Journal*, v. 11, no. 1, Jan. 1961, p. 6 + 3 pages.

RELIABILITY ENGINEERING

On Prediction of System Behavior. The relevance and meaningfulness of reliability predictions are in large measure already determined by the form and fine structure of the subsystem or component data. In the context of an explicit model, we may expose and examine the definite methodological choices available to the reliability statistician or engineer for controlling the form of these data. ***Joan R. Rosenblatt.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Dec. 1960, p. 23-28. (TK1 In6.6q Vis.)

An Application of the Information Theory Approach to Failure Diagnosis. Brulé, Johnson, and Kletsky have developed a technique based on information theory which leads to highly efficient procedures for diagnosing equipment failures. This paper demonstrates the validity of this technique. ***E. J. Kletsky.*** *IRE Transactions on Reliability and Quality Control*, v. RQC-9, Dec. 1960, p. 29-39. (TK1 In6.6q Vis.)

RUBBER AND ELASTOMERS

*** Mechanochemical Reactions of Natural Rubber With Phenolic Resins.** The reaction of polyfunctional metallic salts with natural rubber during mastication has been extended to gelation by phenolic resins. High gel contents are achieved by mastication with 1 to 2% of resin in the absence of oxygen. By using polyphenols and phenol alcohols, it has been shown that an average of at least three functional groups, -OH or $-CH_2OH$, per molecule are required to achieve gelation. ***R. J. Ceresa.*** *Institution of the Rubber Industry, Transactions*, v. 36, no. 5, Oct. 1960, p. 211-224.

*** The Effect of Vulcanization on the Adhesion of Elastomers to Non-Vulcanizable Polymers.** An optimum of vulcanization in the stability of binding in rubber-fabric goods and materials can be utilized in the manufacturing practice. At the present time, vulcanization is based on optimum physicomechanical properties of rubber. According to the investigation, the reduction of the vulcanization time leads to an increase in binding stability. (*In Russian.*) Vliianie vulkanizatsii elastomerov na ikh adgeziiu k nevulkanizuiushchimsia polimeram. ***V. G. Raevskii and S. S. Vointskii.*** *Akademiia Nauk SSSR, Doklady*, v. 135, no. 1, Nov.-Dec. 1960, p. 133-136.

Watch These Trends in Elastomers. Co-polymers of mono- and di-olefins open up new areas for elastomers. ***Herman F. Mark and Sheldon M. Atlas.*** *Petroleum Refiner*, v. 39, Dec. 1960, p. 149-152.

*** The Cross-Linking and Chain Fracture of Rubber by High-Energy Radiation. *P. Hayden.*** *International Journal of Applied Radiation and Isotopes*, v. 8, nos. 2-3, July 1960, p. 65-71.

*** Heat Resistance Properties of Fluorel Elastomer. *D. A. Stivers, Don L. Peterson, and Galen R. Meier.*** *Rubber Age*, v. 88, no. 2, Nov. 1960, p. 292-296.

*** The CEPAR Apparatus—A Versatile Instrument for Measuring Processing Characteristics of Rubber Mixes.** Elastic stiffness, orifice flow resistance, hot recovery, and extruder swell may all be measured in a rapid and continuous manner on this new apparatus and may be used to evaluate and control factory operations with many rubber stocks. ***F. S. Conant and W. E. Claxton.*** *Rubber World*, v. 143, no. 2, Nov. 1960, p. 71 + 7 pages.

Elastomer Modified Asphalts. Further development of elastomer modified asphalts depends on recognition, by highway engineers, of the benefits of such material, particularly in surface treatments. Eventually, it might be expected that all asphaltic materials used for highway purposes may be modified by elastomers, for even more and better service. ***Jewell R. Benson.*** *Utah Engineering Experiment Station, Bulletin No.* 12, Aug. 30, 1960, p. 107-114.

*** Radiation-Induced Compression Set on Elastomeric Compounds.** A modified method for determining compression set of irradiated samples was developed. It is a modified version of ASTM D 395-55, Method B, that differs in size of pellet and in calculations to eliminate the effect of pre-exposure set. The method for determining the correction was shown. ***E. E. Mooney and S. T. Semegen.*** *Rubber World,* v. 143, no. 3, Dec. 1960, p. 75-82.

*** Quick Extrusion of Vercoryl Compounds.** Explains why Vercoryl gives better results than other clay type fillers, in natural rubber as well as Neoprene. Studies how the strength of shapes with Vercoryl filler may be improved by substituting all or part of the smoked sheet by SPR or Polysar SX-371, and of Neoprene WRT by Neoprene WB or WHv, while preserving good mechanical properties and reducing the cost of compounds. (*In French and English.*) Le boudinage rapide des mélanges a base de Vercoryl. ***Jean Dumonthier.*** *Revue Générale du Caoutchouc,* v. 37, Nov. 1960, p. 1497-1502.

*** The Oxidative Aging in Ultraviolet Light of Dicumyl Peroxide Vulcanizates of Natural Rubber in Presence of Various Antioxidants.** The oxidative degradation of peroxide vulcanized natural rubber at wavelengths of 300 mμ and above has been studied by the technique of stress relaxation. Substituted naphthylamines and *p*-phenylenediamines, particularly the former, initially photosensitize the degradation of the vulcanizate but subsequently give rise to colored products which act as antioxidants. ***J. R. Dunn.*** *Journal of Applied Polymer Science,* v. 4, no. 11, Sept.-Oct. 1960, p. 151-158.

*** The Strain Dependence of Rubber Viscoelasticity. II. The Influence of Carbon Black.** Elastic and viscous components of the dynamic Young's modulus were measured at strains up to 80% and over a temperature range of −30 C to +30 C for natural rubber containing 18% by volume of carbon black. ***P. Mason.*** *Journal of Applied Polymer Science,* v. 4, no. 11, Sept.-Oct. 1960, p. 212-218.

*** Testing Five Grams of Rubber.** By means of a specially designed two-roll mill, the use of small hydraulic presses with electrically heated platens, and special molds for the vulcanization of micro test specimens, the compounding, mixing, and testing of five-gram samples of rubber have been accomplished satisfactorily. ***G. J. Briggs, W. H. Embree, E. G. Kent, and W. H. Watson.*** *Rubber World,* v. 143, no. 4, Jan. 1961, p. 54-59.

SPACE HEATING AND CONDITIONING

Hospitals: A Challenge to Air Conditioning Engineers. Describes the needs of the large areas where patients are housed, and tells frankly how each of the systems commonly used—packaged units, central station systems, fan-coil units, induction and double-duct systems,—can be expected to serve these needs. ***John A. Holbrook.*** *Heating, Piping & Air Conditioning,* v. 33, Jan. 1961, p. 158-161.

How to Apply High Intensity Infrared Heaters for Comfort Heating. Interest in high-intensity infrared radiant heating for large-volume industrial and commercial spaces is increasing. Many successful installations have been made and more are in the design or installation stage. Some of the factors to be considered in design based upon visits to a number of plants, and case histories of several interesting designs are presented. *Heating, Piping & Air Conditioning,* v. 33, Jan. 1961, p. 229-244.

*** Noise Measurement in Cylindrical Fan Ducts.** Suggests that a simple windshield over a microphone will suffice for measurements on most ventilating fans. ***A. J. Barrett and W. C. Osborne.*** *Institution of Heating and Ventilating Engineers,* v. 28, Dec. 1960, p. 306-318.

*** Piezoelectric Indicator for Refrigerating Compressors.** A new indicator with piezoceramic pressure pickups, developed at VNIKhI for indicating refrigerating compressors is described. The utilization, as sensitive element, of piezoceramics, characterized by large piezomodulus and internal capacity, allowed a simple design of the instrument to be developed. The instrument comprises a pickup, cathodic repeater and conventional oscillograph. The design of the pressure pickup for various operating conditions and the electrical diagram of the indicator are given. (*In Russian.*) P'ezozlektricheskiĭ indikator dlia kholodil'nykh kompressorov. ***E. Agarev, L. Medovar, and I. Pavlova.*** *Kholodil'naia Tekhnika,* v. 37, no. 6, Nov.-Dec. 1960, p. 21-26.

*** Refrigerating Unit AK2FV-/6/3 With Air Cooled Condenser.** A brief description and the results of tests of the freon-12 air cooled condensing unit of 3000 Kcal/hr nominal capacity. The capacity, performance factor and condensation temperatures of the unit for cooling air temperatures of 20, 30, and 40 C and for fans of various capacities are given. Air cooled and water cooled units are compared. Suggestions are made for improving the design. The fields of application of the unit are indicated. (*In Russian.*) Kholodil'nyĭ agregat AK2FV-6/3 s vozdushnym okhlazhdeniem kondensatora. ***D. Ioffe.*** *Kholodil'naia Tekhnika,* v. 37, no. 6, Nov.-Dec. 1960, p. 4-8.

*** Sun Control—A New Development.** A simple method of sun control offers a very flexible way of controlling solar energy, at the same time taking due regard of illumination, visibility to the outside and the effect of color which can, if necessary, be eliminated by the use of the neutral grey tints. ***J. H. Alderson.*** *Institution of Heating and Ventilating Engineers,* v. 28, Dec. 1960, p. 321-323.

*** The Testing of a Low Heat Potential Steam Jet Refrigerating Machine.** The designing of a steam jet refrigerating machine utilizing hot water heat for refrigeration will permit their installation at heat utilizers of heating and power plants, thus increasing the heat load of the latter. Gives the results of tests of a steam jet refrigerating unit operating at steam pressure of 0.3 atm. The steam may be obtained from water with a temperature of 70-75 C. (*In Russian.*) Isyptaniia paroezhektornoĭ kholdil'noĭ mashiny, ispol'zuiushcheĭ teplo nizhogo potentsiala. ***N. Zinger and K. Andreeva.*** *Kholodil'naia Tekhnika,* v. 37, no. 6, Nov.-Dec. 1960, p. 12-15.

TEXTILES, FIBERS, LEATHER, AND PAPER

*** The Effects of Hydrosulfide Additions in the Tanner's Pit.** The suppression of swelling in the lime liquor by NaSH is achieved not only by replacing all or part of the Na_2S by NaSH, but also by an addition of NaSH without any alteration of the normal composition of the lime, provided that there is at least 3.5–4% Na_2S present (based on pelt weight). (*In German.*) Die Wirkung von Sulfhydratzusätzen im Äscher. ***S. Hörig.*** *Leder,* v. 11, Nov. 1960, p. 270-272.

*** Adhesives: Their Future in the Wood Industry.** Gluing offers one of the best means of improving the utilization of timber resources in the future, and of holding and increasing the markets for wood products in many important areas. ***R. F. Blomquist and H. O. Fleischer.*** *Forest Products Journal,* v. 10, Dec. 1960, p. 626-630.

*** The Use of Wood in Tomorrow's House.** Promotes better understanding of the housing industry's needs and problems to help the wood industries meet the changing requirements in this field. ***H. O. Fleischer.*** *Forest Products Journal,* v. 10, Dec. 1960, p. 648-650.

*** X-Ray Crystallinity Estimations of Randomly and Longitudinally Orientated Fibres of Regenerated Cellulose.** Reviews the influence of technical cellulose concentrations in viscose on the degree of crystallinity, the effect of prolonged regeneration in coagulated fibers, the importance of stretch in attaining orientation and improved order in Hermans' fibers. ***Marietta Ruck-Florjancic and Heinz Ruck.*** *Svensk Papperstidning,* v. 63, no. 23, Dec. 15, 1960, p. 845-853.

• **Studies on Pulp Crill. II. A Crill Screen.** A screen has been constructed that makes it possible to separate pure crill suspensions from paper pulps. The screening operation is dependent on high-intensity turbulence produced by a rotating disk. ***Bertil Sandgren and Douglas Wahren.*** *Svensk Papperstidning*, v. 63, no. 23, Dec. 15, 1960, p. 854-858.

• **New Stress Values for the Coast White Woods.** Existing strength data on these woods are very meager, but indicate that present stress ratings are ultraconservative. The author recommends an interim grouping of hemlock and the coast true firs at a higher level of stress values until a proposed industry-government study of the problem is completed. ***E. M. Williston.*** *Forest Products Journal*, v. 10, Dec. 1960, p. 621-625.

Washable Non-Iron Fabrics From Wool. Setting, which consists of steaming fabrics containing 50% by weight of 1% sodium bisulphite solution for 5 min on a blowing machine, prevents surface distortion of the fabrics during subsequent washing. The shrinkproofing and setting procedures have now been developed for industrial use, and methods of overcoming problems in dyeing, preventing stiffening during setting, and producing fabrics free from relaxation shrinkage are described. ***A. J. Farnworth, M. Lipson, and J. R. McPhee.*** *Textile Institute, Journal, Transactions*, v. 51, Dec. 1960, p. 1504-1516.

The Development of Wash-and-Wear Fabrics for Modern Home Laundering. Use of finer rather than coarser yarns, and compact construction were most important for shrinkage control. Most of the fabrics were muss-resistant, and they were superior in this respect to many textiles presently considered as wash-and-wear. Mussiness increased with decreasing fabric weight. Secondary effects were due to the arrangement of a given fiber weight in finer two-ply rather than coarser single yarns, which increased mussiness, and low twist, which caused rolling of the fabric edges. ***A. E. Brown and J. F. Krasny.*** *Textile Institute, Journal, Transactions*, v. 51, Dec. 1960, p. 1414-1437.

A Generalized Theory for the Combination of Acid or Alkali With Wool Keratin. A generalized Donnan theory is developed to describe the titration curve of an insoluble protein which possesses unequal numbers of carboxyl and amino groups. The equations derived apply to combination which acid or alkali and include a treatment of the isoelectric point. From the constancy of the isoelectric pH of keratin it is concluded that $K+$ and $Cl-$ do not combine with keratin. ***L. Peters.*** *Textile Institute, Journal, Transactions*, v. 51, Dec. 1960, p. 1290-1301.

• **A Concise Account of Our Present Knowledge of the Structure and Chemical Constituents of Collagen. *N. T. Crosby.*** *Society of Leather Trades' Chemists, Journal*, v. 44, Dec. 1960, p. 551-561.

• **Research in the USSR Tanning Industry. *B. D. Breyer.*** *Society of Leather Trades' Chemists, Journal*, v. 44, Dec. 1960, p. 562-567.

WELDING AND JOINING

Ceramic Tooling and Honeycomb Brazing Fixtures for Supersonic Aircraft Production. Describes a program to develop ceramic brazing fixtures and tools from rebonded fused silica. A method of simultaneously forming and heat-treating stainless steel using such tools is described. The merits of blanket-brazing and furnace-brazing techniques are discussed as each applies to the brazing of large honeycomb stainless steel panels. The fabrication of large fixtures for brazing panels several-hundred square feet in area is explained. ***J. D. Walton, Jr. and N. E. Poulos.*** *American Ceramic Society Bulletin*, v. 39, Dec. 1960, p. 740 + 4 pages.

Properties of Chromium-Steel Weld Metal. The effect of temperature upon the tensile, hardness and microstructure characteristics of chromium steel welds is described and data are applicable to design and service needs. ***J. Heuschkel.*** *Welding Journal* (Suppl.), v. 39, Nov. 1960, p. 502s-508s.

Design of Interior Columns in Multi-Story Frames. Discusses use of a special end connection between beams and columns of steel building frames, intended to minimize the moments transferred into the columns. ***J. S. Ellis.*** *Welding Journal*, v. 39, Dec. 1960, p. 538s-542s.

Analytical Investigation of Residual Stresses and Distortions Due to Welding. *Koichi Masubuchi.* *Welding Journal*, v. 39, Dec. 1960, p. 525s-537s.

Fusion-Zone Structures and Properties in Aluminum Alloys. Effects of structure and composition on the properties of arc deposits; effect of welding procedure on structure. ***Paul E. Brown and C. M. Adams, Jr.*** *Welding Journal*, v. 39, Dec. 1960, p. 520s-524s.

Welding of Large Rocket Motors. *J. E. Bartley and R. E. Frala.* *Welding Journal*, v. 39, Dec. 1960, p. 1237-1243.

New Techniques for Cladding With the Gas Shielded Process. Describes method for producing high-quality overlays of stainless steel, nickel, or copper-base alloys. ***Ralph D. Engel.*** *Welding Journal*, v. 39, Dec. 1960, p. 1222-1229.

• **Canada Welds Largest Solid-Section Building Columns.** Welded columns in 430-ft building replace built-up, riveted shapes. *Welding Design & Fabrication*, v. 33, Nov. 1960, p. 46-47.

• **Leak-Free Welds Are the Key to World's Largest Stainless Steel Spheres.** A 75,000-gal low-pressure tank and an 8,000-gal high-pressure tank hold liquid O for air force missiles. *Welding Design & Fabrication*, v. 33, Nov. 1960, p. 38-40.

• **Particulars of Austenite Transformation and Formation of "Cold" Cracks in Fusion Welding.** Equipment for the reproduction of thermal cycles in the heat-affected zone during welding was used in studying structural changes in base metal and weld metal. The results obtained showed the effect of heating and cooling rate in the Ac_1 and Ac_3 temperature range and the influence of maintaining the temperature above Ac_3 on the mechanism of austenite transformation. The choice of a suitable welding process and suitable welding conditions makes it possible to exclude any possible formation of "cold" cracks. (*In French.*) Particularités de la transformation de l'austénite et de la formation de fissures "froides" lors de soudage par fusion. ***N. N. Rykaline and M. K. Chorchorov.*** *Soudage et Techniques Connexes*, v. 14, no. 9/10, Sept.-Oct. 1960, p. 335-347.

Welding of High-Strength Steels for Rocket Cases. Investigation indicates that low-C filler and grain refinement improve notch properties and, under the most severe conditions of stress concentration and temperature, result in the best combination of notch strength and ductility. ***W. H. Kearns, J. W. Semmel, and J. D. Marble.*** *Welding Journal* (Suppl.), v. 39, Nov. 1960, p. 484s-492s.

Welding of Nickel-Chromium-Iron Alloy for Nuclear-Power Stations. New nickel-chromium-iron alloy covered electrode and inert-gas-shielded filler wire developed to meet the rigid welding standards set for nuclear-power station applications. ***C. E. Witherell.*** *Welding Journal* (Suppl.), v. 39, Nov. 1960, p. 473s-478s.

The Heat-Affected Zone of Arc-Welded Ductile Iron. A study of the effect of the cooling rate of various regions of a weldment on the formation of martensite and massive carbides and the redeposition rate of C on existing graphite spheroids during cooling. ***E. F. Nippes, W. F. Savage, and W. A. Owczarski.*** *Welding Journal* (Suppl.), v. 39, Nov. 1960, p. 465s-472s.

• **Influence of Electrode Spacing Upon the Welding Current During Twin Spot Welding.** Current distribution on top sheet, bottom sheet and bottom plate—development of an equation for the current distribution from an analogue scheme—design of the experimental equipment—experiments with bright, scaled and sand blasted sheets—influence of sheet thickness—observation by means of oscilloscope records and graphical representation of current distribution. (*In German.*) Einfluss des Elektrodenabstandes auf den Stromverlauf beim Doppelpunktschweissen. ***W. Brunst and K. Bauer.*** *Schweissen und Schneiden*, v. 12, Oct. 1960, p. 453-456.

* **Induction Heated Brazing.** Principle of induction heating; basic design of the induction heated brazing plant; shape of inductor coils; brazing with high and medium frequencies; design requirements of the parts to be joined; fixtures fluxes; possibilities of application and examples. (*In German.*) Löten mit induktiver Wärmeerzeugung. ***K. Flick.*** *Schweissen und Schneiden,* v. 12, Oct. 1960, p. 447-452.

* **Influencing Conditions of Electroslag Welding With Plate Electrode on the Shape and Dimensions of Welded Joint.** The width of the welding penetration increases with the increase of the welding voltage and thickness of the electrode. Increasing the feeding speed and the gap to a definite limit causes an increase of the width of melting. Further increase of these parameters of welding decreases the welding penetration. The depth of the metallic bath is increased with the increase of the speed of the feed and of the thickness of the electrode, and is somewhat decreased with the increase of the welding voltage. (*In Russian.*) Vliianie rezhima elektroshlakovoĭ svarki plastinchatym elektrodom na formu i razmery svarnogo soedineniia. ***Iu. N. Zaitsev and A. M. Rogalev.*** *Svarochnoe Proizvodstvo,* 1960, no. 10, Oct., p. 18-20.

Welding Repairs of Cavitation on Large Hydroelectric Turbines. Cavitation conditions in hydroelectric turbines lead to pitting in the runners and can cause major damage. When the degree of pitting becomes excessive, repair is in order. This article attempts to discuss some of the problems encountered in the repair of these turbines in place at the dam site without dismantling the turbine. Also, it gives general procedure directions in overcoming not only the actual welding problems, but those encountered in selecting and maintaining equipment used on the job, and the various steps involved in weld preparation, welding and finishing. ***Martin Friedmann, Jr.*** *Welding Journal,* v. 39, Nov. 1960, p. 1124-1126.

Welding or Brazing Dissimilar Metals. Describes ways of making pressure-tight joints by fusion-welding, brazing, or braze-welding. ***Jay Bland.*** *Product Engineering,* v. 31, no. 52, Dec. 19, 1960, p. 46-49.

High-Strength Structural Adhesives. Physical properties of elastomeric phenolics and modified epoxies, and techniques for applying these adhesives to bond structural parts. ***E. F. Hess.*** *Machine Design,* v. 33, Jan. 5, 1961, p. 149-152.

Magnetic Force Welding. Discussion of the ability of the process to provide combinations of heat, time and pressure not obtainable with conventional resistance welding equipment. ***C. A. Rowlands.*** *Welding and Metal Fabrication,* v. 28, Dec. 1960, p. 474-481.

Recent Work on Pressure Welding. Surface preparation; properties and industrial applications of pressure welds. ***R. F. Tylecote.*** *Welding and Metal Fabrication,* v. 28, Dec. 1960, p. 491-494.

* **A New Gun-Type CO_2 Welding Torch.** Recently developed torch regulates the forward and backward movement of the protective gas by means of a stage selector switch. (*In German.*) Ein neuer CO_2-Schweissbrenner in Pistolenform. ***Herbert Berger.*** *Schweisstechnik* (Berlin), v. 10, Nov. 1960, p. 421-422.

The Problem of Welding High Temperature Service Materials. Refers to investigations on the welding of ferritic steels for high-temperature service, containing 1.0-9.0% Cr and 0.5-1.0% Mo, and describes the properties of joints made by various welding processes. The possibilities of welding austenitic and ferritic steels with nickel alloy electrodes are discussed. ***E. Kauhausen, P. Kaesmacher, and S. Sadowski.*** *British Welding Journal,* v. 7, Dec. 1960, p. 693-707.

Hot Pressure Welding of Titanium. Values of deformation and pressure required to give welding between room temperature and 900 C were obtained. Pressure butt welding of Ti bar was carried out between 500 and 900 C and the tensile results are reported together with the microscopical changes occurring at the interface. A heat treatment of 30 min. at 950 C increased the tensile properties of welds to those of the parent material. ***C. F. Wilford and R. F. Tylecote.*** *British Welding Journal,* v. 7, Dec. 1960, p. 708-712.

* **Tests on Pipes With Induction Welded Longitudinal Seams.** Limitation of the process. Manufacture of pipes with welded longitudinal seams. Results of destructive and non-destructive tests. Expanding, bending, aging, folding, and bursting tests. Investigations of crystal structure. Advantages of longitudinally welded pipes as compared with seamless pipes. (*In German.*) Ergebnisse und Erfahrungen bei der Prüfung von induktiv längsnahtgeschweissten Rohren. ***T. Furkel.*** *Schweissen und Schneiden,* v. 12, Dec. 1960, p. 517-525.

Inert-Gas Spot Welding in the Aircraft and Missile Industry. . . . a valuable production tool for fabricating structures from high-tensile heat-treatable steels. Process features are simplicity of application, flexibility and reliability. ***R. L. Hackman.*** *Welding Journal,* v. 40, Jan. 1961, p. 25-33.

Vapor-Shielded Arc Welding at 200 ipm. This automatic process is ideally suited to round parts that can be fabricated on a rotating positioner. Advantages are; fast travel speeds, no external flux with attendant problems, no external shielding gas with concurrent demands, light slag, over-all cleanliness. ***R. A. Wilson.*** *Welding Journal,* v. 40, Jan. 1961, p. 13-17.

* **Index Numbers of Oxy-Fuel Flames for Welding.** Conventional specification of the properties of oxy-fuel gas flames; necessity for specifying flames for particular purposes; tests for determining efficiency, rate of exploitation, and temperature distribution in the workpiece as a function of flame properties; determination of temperature distribution in a disc; expressing index numbers by three figures; effects on the application of various welding processes. (*In German.*) Schweisstechnische Kennwerte für Brenngas-Sauerstoff-Flammen. ***K. Teske.*** *Schweissen und Schneiden,* v. 12, Dec. 1960, p. 507-513.

Arc Welding of a Ni-Cr-Fe (Inconel) Alloy for Nuclear Power Plants. Describes structural and cladding weld tests as carried out with three shielded-arc processes, using Inconel-type filler metals containing Cb, Cb-Mn or Ti additions. ***Jay Bland and W. A. Owczarski.*** *Welding Journal,* v. 40, Jan. 1961, p. 22s-32s.

Electrode for Spatter-Free Welding of Steel in Carbon Dioxide. Spatter-free metal transfer is only one of the advantages of adding Na, K, or Rb to cesium wire coatings in the CO_2-shielded metal-arc welding of mild steel. ***Everett Cushman.*** *Welding Journal,* v. 40, Jan. 1961, p. 14s-21s.

Modern Glues. Conventional "natural" adhesives are now being displaced by entirely synthetic glues, among which the polyamide and silicone preparations appear to have the greatest potential. After an account of the general nature of adhesion the qualities of several groups of synthetic resins are discussed. ***R. F. Webb.*** *Research Applied in Industry,* v. 13, Dec. 1960, p. 481-484.

* **Electron Beam Welding Those Hard-to-Join Metals.** . . . for joining assemblies that must be evacuated and sealed, for joining reactive and refractory alloys, for joining thin sections, etc. ***Mars Hablanian.*** *Assembly & Fastener Engineering,* v. 4, Jan. 1961, p. 36-40.

MISCELLANEOUS

Station Detects Underground Nuclear Blasts. Air Force station in southern Oklahoma may promote international agreement on stopping nuclear-weapons tests. It uses 21 seismometers, phototube amplifiers and processing equipment. *Electronics,* v. 33, no. 49, Dec. 2, 1960, p. 34-35.

* **Internal Migration Statistics for the United States.** A methodological survey of statistics on internal migration used in the new enlarged edition of *Historical Statistics of the United States.* No one body of materials gives a complete picture, but much can be pieced out from the essentially complementary series that exist. Important series can be derived from census age-sex-color-nativity distributions by survival methods. All such estimates are inexact, but important migration streams are clearly delineated. ***Everett S. Lee and Anne S. Lee.*** *American Statistical Association, Journal,* v. 55, no. 292, Dec. 1960, p. 664-697.